

NUCLEAR SCIENCE ABSTRACTS

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Atomic Energy Project, Univ. of Calif., Los Angeles		SPECIAL INTEREST TO AEC LABORATORIES	
STUDIES ON THE NEW HAMPSHIRE CHICKEN EMBRYO.			
2. ULTRACENTRIFUGAL STUDIES OF THE SERUM		AERE-C/R-1061	2864
PROTEINS. Ole Arne Schjeide and Lee Deutsch. Feb. 25,		Atomic Energy Research Establishment, Harwell, Berks,	
1953. 19p. (UCLA-246)		(England)	
UCLA-248	2733	THE SPECTRUM OF THE RADIATION EMITTED DURING	
Atomic Energy Project, Univ. of Calif., Los Angeles		μ -MESON CAPTURE BY CARBON. F. D. S. Butement.	
THE EFFECT OF X-IRRADIATION ON SERUM POTASSIUM		Nov. 18, 1952. 4p. (AERE-C/R-1061)	
AND SODIUM LEVELS IN RABBITS. Raymond D. Goodman			
and Marcus Vogel. Mar. 10, 1953. 14p. (UCLA-248)			
UCRL-2036	2826	AERE-C/R-1068	2777
Radiation Lab., Univ. of Calif., Berkeley		Atomic Energy Research Establishment, Harwell, Berks	
SURFACE GRADIENT VS. ELECTRODE CONTOUR IN A		(England)	
RESONANT CAVITY. A. D. Schelberg. Dec. 4, 1952. 23p.		CHEMICAL DOSIMETRY AT HIGH DOSE RATES. N. Miller.	
(UCRL-2036)		Dec. 12, 1952. 9p. (AERE-C/R-1068)	
UCRL-2040	2764	AERE-Inf/Bib-76(suppl. 1)	2879
Radiation Lab., Univ. of Calif., Berkeley		Atomic Energy Research Establishment, Harwell, Berks	
PHOTOSYNTHESIS (THE PATH OF CARBON IN PHOTO-		(England)	
SYNTHESIS AND THE PRIMARY QUANTUM CONVERSION		BIBLIOGRAPHY ON FISSION, SUPPLEMENT 1: COVERING	
ACT OF PHOTOSYNTHESIS). Melvin Calvin. Nov. 22,		REFERENCES UP TO SEPTEMBER 1952. Oct. 1952. 9p.	
1952. 31p. (UCRL-2040)		(AERE-Inf/Bib-76(suppl. 1))	
UCRL-2049	2843	AERE-M/R-1054	2808
Radiation Lab., Univ. of Calif., Berkeley		Atomic Energy Research Establishment, Harwell, Berks	
EXTENDING THE RANGE OF A SELF-BALANCING RE-		(England)	
CORDING POTENTIOMETER WITHOUT REDUCING RESO-		THE "ELASTIC HYSTERESIS" OF URANIUM. W. Munro	
LUTION. H. B. Keller and C. G. Dols. Dec. 12, 1952.		and E. R. W. Jones. Nov. 18, 1952. 12p. (AERE-M/R-	
15p. (UCRL-2049)		1054)	
UCRL-2074	2750	AERE-M/R-1060	2918
Radiation Lab., Univ. of Calif., Berkeley		Atomic Energy Research Establishment, Harwell, Berks	
THE PATH OF CARBON IN PHOTOSYNTHESIS. 18. THE		(England)	
IDENTIFICATION OF NUCLEOTIDE COENZYMES. J. G.		THE INFLUENCE OF CROSSLINKING ON THE ELASTIC	
Buchanan, V. H. Lynch, A. A. Benson, M. Calvin, and D. F.		MODULUS OF POLYTHENE. A. Charlesby and N. H.	
Bradley. Jan. 19, 1953. 24p. (UCRL-2074)		Hancock. Dec. 3, 1952. 11p. (AERE-M/R-1060)	
UCRL-2091	2899	AERE-T/R-1062	2723
Radiation Lab., Univ. of Calif., Berkeley		Atomic Energy Research Establishment, Harwell, Berks	
DIFFERENTIAL CROSS SECTION FOR THE ELASTIC		(England)	
SCATTERING OF 32 MEV PROTONS BY DEUTERONS		CALCULATIONS OF TOLERANCE FLUX OF FAST NEU-	
(thesis). Val J. Ashby. Jan. 28, 1953. 50p. (UCRL-2091)		TRONS TAKING INTO ACCOUNT THE EFFECT OF ENERGY	
		LOSS DUE TO NON-HYDROGENOUS NUCLEI IN THE	
		TISSUE. M. B. Biram. 1952. 7p. (AERE-T/R-1062)	
UCRL-2103	2827	AMRL-89	2852
Radiation Lab., Univ. of Calif., Berkeley		Army Medical Research Lab., Fort Knox	
EMPIRICAL CONSIDERATIONS OF ENTROPY. 1. THE		SCINTILLATION COUNTERS. A. T. Krebs. Aug. 11, 1952.	
ENTROPIES OF THE OXY-ANIONS AND RELATED		67p. (AMRL-89)	
SPECIES. James W. Cobble. Feb. 3, 1953. 14p. (UCRL-			
2103)			
UCRL-2107	2890	AMRL-94	2724
Radiation Lab., Univ. of Calif., Berkeley		Army Medical Research Lab., Fort Knox	
SUMMARY OF RESEARCH PROGRESS MEETING OF		A STUDY OF COMBINED THERMAL RADIATION BURN	
JANUARY 15, 1953. Sergey Shewchuck. Feb. 10, 1953.		AND X-IRRADIATION EFFECTS ON MICE. W. H. Parr,	
8p. (UCRL-2107)		V. M. Daggs, T. A. O'Neill, and S. G. Bush. Sept. 4, 1952.	
		11p. (AMRL-94)	
		AMRL-102	2737
		Army Medical Research Lab., Fort Knox	
		STUDIES ON THE PROTECTIVE ACTION OF SULPHYDRYL	

COMPOUNDS AGAINST X-IRRADIATION. W. H. Parr, N. Puckett, R. Ransom, S. Spradling, and A. Krebs. Nov. 12, 1952. 19p. (AMRL-102)		J. Soc. Ing. Automobile 24, 135-8(1951). 10p. (NP-2412; ACSIL/ADM/52/189; ACSIL-Trans. No. 540)
DC-52-28-140	2809	NP-4443
Babcock and Wilcox Co.		Sarah Mellon Scaife Radiation Lab., Univ. of Pittsburgh RADIATION DAMAGE STUDY; REPORT NO. 1 [FOR] APRIL AND MAY 1952. 17p. (NP-4443; Report No. 1)
EXPERIMENTAL INVESTIGATIONS OF CORROSION AND EROSION OF LIQUID METAL SYSTEMS: PROGRESS REPORT FOR JULY 15, 1952-AUGUST 15, 1952. A. W. Dana, Jr. and O. H. Baker. Aug. 15, 1952. 13p. (DC-52-28-140; [B and W]-5235)		NP-4447
GS-C-248	2801	Air Force Radiation Lab., Univ. of Chicago QUARTERLY PROGRESS REPORT NO. 6. Jan. 15, 1953. 70p. (NP-4447)
Geological Survey		NP-4455
PRELIMINARY SUMMARY OF RECONNAISSANCE FOR URANIUM AND THORIUM IN ALASKA, 1952. Helmuth Wedow, Jr., et al. 1953. 17p. (GS-C-248)		Illinois Univ. ORDVAC MANUAL [FOR] 1952. Oct. 31, 1951. 414p. (NP-4455)
NACA-TN-2890	2811	NP-4457
Lewis Flight Propulsion Lab., NACA		Department of Mines and Technical Surveys, Mines Branch, Ottawa (Canada). USE OF 2,2-DIQUINOLYL IN THE COLORIMETRIC DETERMINATION OF COPPER IN MINERALS AND ORES. R. J. Guest. Dec. 9, 1952. 15p. (NP-4457; TR-105/52)
A LINEAR TIME-TEMPERATURE RELATION FOR EXTRAPOLATION OF CREEP AND STRESS-RUPTURE DATA. S. S. Manson and A. M. Haferd. Mar. 1953. 49p. (NACA-TN-2890)		NP-4459
NACA-TN-2916	2794	Institute of Engineering Research, Univ. of Calif., Berkeley EFFECT OF STRESS ON THE CREEP RATES OF POLYCRYSTALLINE ALUMINUM ALLOYS UNDER CONSTANT STRUCTURE. O. D. Sherby, R. Frenkel, J. Nadeau, and John E. Dorn. Feb. 15, 1953. 28p. (NP-4459; Technical Report 24)
Langley Aeronautical Lab., NACA		NP-4460
EFFECT OF THERMAL PROPERTIES ON LAMINAR-BOUNDARY-LAYER CHARACTERISTICS. E. B. Klunker and F. Edward McLean. Mar. 1953. 29p. (NACA-TN-2916)		Applied Research Labs., Glendale, Calif. RESEARCH INVESTIGATIONS DIRECTED TOWARD ESTABLISHMENT OF METHODS FOR QUANTITATIVE SPECTROGRAPHIC ANALYSES OF RAW AND PROCESSED MATERIALS: SECOND QUARTERLY REPORT [FOR] JANUARY 16, 1952 TO APRIL 15, 1952. M. F. Hasler and J. W. Kemp. 17p. (NP-4460; U-22481; Progress Report No. 2)
NBS-2165	2841	NP-4461
National Bureau of Standards		Dynamic Properties Lab., Calif. Inst. of Tech. DYNAMIC STRESS-STRAIN RELATIONS FOR ANNEALED 2S ALUMINUM UNDER COMPRESSION IMPACT. J. E. Johnson, D. S. Wood, and D. S. Clark. Feb. 1953. 63p. (NP-4461; Technical Report 7)
A DIAPHRAGM-TYPE, CAPACITANCE-TYPE, MICROMANOMETER FOR VERY LOW DIFFERENTIAL PRESSURES. Thomas A. Perls, William H. Kaechele, and Daniel S. Galwin. Jan. 1953. 16p. (NBS-2165)		NP-4471
NBS-2167	2718	Standard Oil Co. of Ind. DEVELOPMENT AND EVALUATION OF A GREASE FOR -65° TO +450°F. QUARTERLY REPORT [FOR] MAY 18 TO AUGUST 18, 1952. Cecil G. Brannen and Edward A. Swakon. Aug. 1952. 25p. (NP-4471; Quarterly Report No. 5)
National Bureau of Standards		NP-4477
METHODS OF RESPIRATORY GAS ANALYSIS. Harold J. Morowitz. June 1952. 17p. (NBS-2167)		Magnesium Labs., Dow Chemical Co. LIQUIDUS DETERMINATIONS OF POLYNARY MAGNESIUM ALLOYS; FINAL STATUS REPORT [FOR] DECEMBER 1, 1949-APRIL 15, 1950. 27p. (NP-4477; Report 15004)
NBS-2179	2746	NP-4479
National Bureau of Standards		Electrochemistry Research Lab., Western Reserve Univ. THE CATHODIC POLARIZATION ASSOCIATED WITH THE OXYGEN ELECTRODE. Ernest Yeager, R. R. Witherspoon, Herman Urbach, and Frank Hovorka. Mar. 15, 1953. 27p. (NP-4479; Technical Report 2)
THE BIOLOGICAL EFFECTS OF DEUTERIUM COMPOUNDS. Harold J. Morowitz and Lawrence M. Brown. Jan. 14, 1953. 50p. (NBS-2179)		TEM-605
NBS-2264	2896	Geological Survey
National Bureau of Standards		AIRBORNE RADIOACTIVITY SURVEY OF THE DEVILS TOWER AREA, CROOK COUNTY, WYOMING. J. R. Henderson and R. M. Moxham. [Feb. 1953] 1p. (TEM-605)
AN EXPERIMENT ON GAMMA-RAY BACKSCATTERING. Evans Hayward and John H. Hubbell. Feb. 10, 1953. 71p. (NBS-2264)		
NBS-2266	2846	
National Bureau of Standards		
A BIBLIOGRAPHY OF RESEARCH ON THE PROPERTIES OF THE ISOTOPES OF MOLECULAR HYDROGEN. Abraham S. Friedman and Charles W. Beckett. Mar. 15, 1953. 103p. (NBS-2266)		
NBS-2308	2767	
National Bureau of Standards		
DETERMINATION OF CARBON-14 IN THE TERMINAL POSITIONS OF SUGARS: ASSAY OF D-FRUCTOSE-1,6-C ¹⁴ . Harriet L. Frush and Horace S. Isbell. Mar. 2, 1953. 11p. (NBS-2308)		
NBS-2394	2786	
National Bureau of Standards		
FLUORINE SUBSTITUTION IN HYDROXY SILICATES AND RELATED MINERALS: QUARTERLY REPORT FOR PERIOD ENDING FEBRUARY 28, 1953. A. Van Valkenburg and G. Rynders. Feb. 1953. 17p. (NBS-2394)		
NP-2412	2791	
THE FLUID BEARING. Paul Gerard. Translated From		

BIOLOGY AND MEDICINE

2715

Argonne National Lab.

PHASE-CONTRAST AND ELECTRON MICROSCOPE STUDIES ON THE GOLGI BODIES AND MITOCHONDRIA OF THE GERM CELLS OF *HELIX ASPERSA*. Harold W. Beams and Theodore N. Tahmisan. Iowa State Univ. and Argonne National Lab. Feb. 1953. 18p. (AECU-2444; UAC-718)

The Golgi bodies of the male germ cells of *Helix aspersa* were observed in living cells by aid of the phase-contrast microscope. Their form and distribution were observed to resemble those seen in fixed material in electron micrographs. The bodies were observed to have a fine fibrous internal structure. In ultracentrifuged cells the mitochondria were displaced to the centrifugal end, and the Golgi bodies to the centripetal end, of the cell. From this evidence it is concluded that the Golgi bodies are distinct from the mitochondria. (C.H.)

2716

Institute for Atomic Research, Iowa State Coll.

REVERSAL OF INHIBITION OF VITAMIN B₁₂ GROWTH-PROMOTING ACTIVITY. Erma S. van der Zant and L. A. Underkofler. [nd] 2p. (AECU-2451)

Extracts of swine gastric mucosa (Ventriculin) contain a substance, probably protein, which inhibits the growth-promoting activity of vitamin B₁₂ for *Lactobacillus leichmannii*. This vitamin B₁₂ inhibitory substance is inactivated, that is, it no longer inhibits the growth-promoting action of vitamin B₁₂, when it is added to a standard assay medium, containing amino acids, salts, glucose, vitamins, bases and Tween 80, and the mixture is heated. Autoclaving for 5 min at 15 lb steam pressure or boiling for 10 min are equally effective. There is no appreciable inactivation of the vitamin B₁₂ inhibitory principle when it is heated separately from the assay medium under these same conditions of time and temperature. The constituents of the basal medium were tested for their abilities to inactivate the vitamin B₁₂ inhibitory principle in the following manner. An extract of swine gastric mucosa was diluted so that addition of 1 ml of the dilution per tube would completely inhibit 0.15 mg of vitamin B₁₂ per tube in the bacterial assay. The substances to be tested were added to aliquots of this extract and the solutions heated under the conditions of time and temperature given above. One-ml portions of the resulting solutions were added to assay tubes after the latter had been autoclaved; then the tubes were inoculated, incubated, and the turbidity measured after 22 hr. Growth was an indication of the inactivation of the inhibitory factor. Of all the substances tested only L-histidine with Fe(II) or Mn(II) caused inactivation of the inhibitory principle upon heating, preventing it from reacting with vitamin B₁₂ in the assay medium. None of these substances was active alone. The fact that Fe(II) and Mn(II) ions form complexes which are similar to those of Co(II), and that histidine contains an imidazole ring, suggested that Co and other imidazoles might show a similar effect. Co(II) and benzimidazole were tested with the inhibitory factor and were also

found to be effective in destroying its inhibitory effect. For a hypothesis as to how these substances prevent the action of the inhibitory factor, we propose that the inhibitory substance reacts with benzimidazole and the Co, or with histidine and the metal ion, thus preventing reaction of vitamin B₁₂ with the inhibitory factor in a like manner. This reversal of inhibition may help to explain the nature of the reaction of vitamin B₁₂ with the inhibitory factor, investigation of which is being continued. (Entire Report)

2717

Pittsburgh Univ. School of Medicine

THE INFLUENCE OF ADJUVANTS ON THE ELIMINATION OF SOLUBLE PROTEIN ANTIGENS AND THE ASSOCIATED ANTIBODY RESPONSES. David W. Talmage and Frank J. Dixon. [1953.] 8p. (AECU-2472)

Administration of soluble protein antigens in water-in-oil emulsion results in a prolonged retention of antigen at the injection site. Rate of antigen elimination from the injection site has a half life of approximately 14 days. Alum precipitation of protein antigens causes only slight retention of antigen. The antibody response to emulsified protein antigens is relatively constant for at least 301 days while the response to these antigens in aqueous solution diminishes rapidly after 10 days. (auth)

2718

National Bureau of Standards

METHODS OF RESPIRATORY GAS ANALYSIS. Harold J. Morowitz. June 1952. 17p. (NBS-2167)

A literature survey of various methods for analysis of respiratory gases is presented. 57 references. (L.T.W.)

2719

Atomic Energy Project, Univ. of Calif., Los Angeles TOLERANCE, TOXICITY AND CALORIC AVAILABILITY OF INTRAVENOUSLY INJECTED OXYPOLYGYELATIN SOLUTION IN RABBITS. Lawrence E. Detrick, Virginia Debley, and Thomas J. Haley. Feb. 15, 1953. 14p. (UCLA-244)

Eleven consecutive daily intravenous injections containing 5% oxypolygelatin (OPG) in a nutrient solution, each equivalent to 7.7% of the body weight, produced physical deterioration and illness in rabbits with a comparatively low mortality ratio. Hydropic degeneration in the convoluted tubule epithelium occurred following 4 and 7 injections and was present in all OPG-infused animals sacrificed at the end of the 11-day injection period, but the lesions were not reversible 14 days after the injections were stopped. The glomeruli were not involved. Foam cells were not present in the reticuloendothelial system. Small discrete emboli were frequently seen in the peripheral vessels of the lung but the endothelium of the blood vessels was normal. From comparative experimental results it would appear that physical deterioration, illness and the irreversible hydropic degeneration of the tubule epithelium were dependent upon characteristics of the injected material other than the presence of or proportion of small molecular particles in the polydisperse OPG system. (auth)

2720

THE ACCUMULATION, METABOLISM, AND BIOLOGICAL EFFECTS OF ASTATINE IN RATS AND MONKEYS. Joseph G. Hamilton, C. Willet Asling, Warren M. Garrison, and

Kenneth G. Scott. Univ. Calif. (Berkeley) Publs. Pharmacol. 2, No. 21, 283-344(1953); UCRL-2125.

The experiments reported in this paper have included a study of the metabolism of At and its biological effects on rats and monkeys. Special attention was directed to the behavior of At in the thyroid gland, owing to its selective localization in that organ in both animals. The distribution of At within the thyroid gland was studied by the radioautographic technique, and its concentration was observed to vary in the different acini. The preparation of radioautographs was achieved, and they demonstrated the presence of both At and I in the same sections of thyroid tissue. The administration of stable I in milligram amounts appeared to inhibit the accumulation of At by the thyroid gland. The metabolism of At and radio-I in rats was compared. The apparent secretion of At by the stomach and excretion by the kidneys were somewhat similar to those of radio-I. Otherwise, with the exception of the thyroid gland, the metabolism of At seemed quite different from that of radio-I. Information was obtained from the data which indicated that a rapid equilibrium existed between the tissues and the plasma for both radio elements. The biological effects that followed the administration of large amounts of At to the rat were investigated in considerable detail. The subsequent capacity of the thyroid gland to accumulate radio-I, its distribution, and finally, the morphological changes were studied. Complete obliteration of all functional acini was not attained at the highest dose level of At, which seemed to be within the lethal range. There was no evidence of injury to the parathyroid gland and adjacent peritracheal tissues. The leukopenia, malaise, and weight loss observed were interpreted to indicate radiation injury. The spleen lymph nodes and lacrimal glands showed morphological changes in structure that may have been induced by direct radiation effects from the administered At. Limited studies with the monkey demonstrated the ability of At to produce a profound degree of injury to the thyroid gland. A state of apparent simian myxedema was produced in a monkey, and subsequently this effect seemed to have been reversed by the peroral administration of thyroid substance. Evidence is presented that indicates that the relative biological effects of α particles from At upon the thyroid gland of the rat may be greater than the published values for the destructive action of the less energetic and more penetrating beta-particles from radio-I. (auth)

RADIATION EFFECTS

2721

Michigan Univ.

POTENTIALITIES OF UTILIZING RADIATION FROM FISSION MATERIALS FOR THE PRODUCTION OF CANNED MEAT PRODUCTS. L. E. Brownell, L. L. Kemps, and J. T. Graikoiski. [1952]. 12p. (AECU-2450)

Problems associated with the sterilization of canned meats and other foods by ionizing radiation are reviewed. Radiation dosage required to destroy various micro-organisms, animal-feeding experiments with food exposed to γ radiation, and flavor and texture changes in irradiated foods are discussed. Steps necessary before food can be preserved by γ radiation on a commercial basis are summarized. (C.H.)

2722

[Louisiana State Univ.]

GENETICS AND CYTOLOGY OF A MUTANT, DWARF-SPORED GLOMERELLA. H. E. Wheeler and C. H. Driver. [1952]. 23p. (AECU-2473)

A variant of Globerella cingulata obtained from a culture grown on a medium containing radiocarbon, produced ascospores approximately one-third normal size and which

lacked the curvature characteristic of the ascospores of this species. The results of a genetic and cytological study indicated that the dwarf-spored character was controlled by a mutant gene. A brief discussion of the taxonomic and genetic implications of data presented is included. (C.H.)

2723

Atomic Energy Research Establishment, Harwell, Berks (England)

CALCULATIONS OF TOLERANCE FLUX OF FAST NEUTRONS TAKING INTO ACCOUNT THE EFFECT OF ENERGY LOSS DUE TO NON-HYDROGENOUS NUCLEI IN THE TISSUE. M. B. Biram. 1952. 7p. (AERE-T/R-1062)

The dose in roentgens is calculated at points in a half space of human tissue when a collimated monoenergetic beam of fast neutrons falls normal to the irradiated surface. The variation of mean free path with energy is neglected. The biological effects can then be shown to be proportional to the energy flux which is calculated by using the spherical harmonics P_1 approximations. (auth)

2724

Army Medical Research Lab., Fort Knox

A STUDY OF COMBINED THERMAL RADIATION BURN AND X-IRRADIATION EFFECTS ON MICE. W. H. Parr, V. M. Daggs, T. A. O'Neill, and S. G. Bush. Sept. 4, 1952. 11p. (AMRL-94)

Mice exposed to both total-body x irradiation (720 r) and thermal radiation burns (non-lethal) succumb more rapidly than animals receiving x irradiation only. The mice were burned either immediately before or immediately after irradiation with the over-all result being approximately the same. The possible reasons for the earlier and higher mortality of the mice receiving both x irradiation and non-lethal burns are discussed. (auth)

2725

Argonne National Lab.

QUARTERLY REPORT [FOR] AUGUST, SEPTEMBER, AND OCTOBER 1952; DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH. Austin M. Brues, ed. [nd] 78p. (ANL-4932)

Separate abstracts have been prepared on three sections of this report.

2726

Argonne National Lab.

NEUTRON RADIobiology, RADIUM TOXICITY, EXPERIMENTAL PATHOLOGY, AND CLINICAL INVESTIGATION. Howard H. Vogel, Jr., John W. Clark, Donn L. Jordan, Robert J. Hasterlik, Miriam P. Finkel, Hermann Lisco, Austin M. Brues, Asher J. Finkel, Earl A. Hathaway, and Elaine J. Katz. p.8-25 of QUARTERLY REPORT [FOR] AUGUST, SEPTEMBER, AND OCTOBER 1952; DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH. Austin M. Brues, ed. 18p. (ANL-4932(p.8-25))

The eyes of mice exposed to fast neutrons, γ rays from a Co^{60} source, and a 50-50 mixture of these two radiations, were examined approximately 5 months after irradiation. Data on pathologic changes are presented in tabular form. Fast neutrons were found to be much more effective than Co^{60} γ rays in producing complete cataracts. Data on the response of mouse spleen and thymus to 90-min exposure to fast neutrons are presented graphically. Clinical studies on two patients containing Ra are discussed. Data are presented on the survival and gross pathological changes in rats following administration of Pu^{239} . Studies reported to be in progress are designed to test the efficacy of protective substance against NaK burns of the skin and the therapeutic effects of various types of treatment of such skin burns. Following the accidental exposure of four laboratory members to γ rays and neutron radiation at levels below 200 r, urinary amino-acid excretion was studied by means

of paper partition chromatography. All four patients showed a consistent daily increase in the amounts of amino acids excreted after the accident. The possibility is discussed that aminoaciduria may be a significantly sensitive early indicator of radiation exposure. (C.H.)

2727

Argonne National Lab.

SPECIAL PROBLEMS AND EXPERIMENTAL CYTOLOGY. S. Phyllis Stearner, E. J. B. Christian, Howard S. Ducoff, B. Vincent Hall, J. V. Passonneau, Austin M. Brues, Katherine A. Hamilton, Walter E. Kisielewski, L. Seki, Agnes N. Stroud, R. B. Balder, Jr., C. P. Stroud, and J. M. Gurian. p.26-40 of QUARTERLY REPORT [FOR] AUGUST, SEPTEMBER, AND OCTOBER 1952; DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH. Austin M. Brues, ed. 15p. (ANL-4932(p.26-40))

Data on the effect of partial-body shielding on radiation-induced hypotension in young chicks are presented in tabular form. Paramecium transferred to previously irradiated medium showed a 2-hr growth delay, irradiated cells in fresh medium showed a 10-hr delay and irradiated cells in irradiated medium were delayed about 12 hr. Possible explanations for the growth delay are discussed. Structural features of the glomerulus are described as observed in ultrathin sections of rat kidney under the electron microscope. Rats were exposed to β rays of $\text{Sr}^{90}-\text{Y}^{90}$ over a 35-cm² area using 1500 μc diffusely distributed or in the form of 10, 20, or 50 point sources. Following the death of the last rat 741 days after exposure it was determined that survival was significantly less in all of the irradiated groups than in controls at all times after 350 days. Malignant tumors were not seen in the 60 controls, while 71 skin carcinomas, 73 sarcomas, and 15 adenocarcinomas of mammary origin appeared in the 405 experimental rats. Fractions of human plasma administered intravenously in saline to mice 6 min before exposure to 800-r \times radiation gave protection to 80% of the group when doses of 23 mg were used, while only 1% of the controls survived. Data are presented which indicate that diethylstilbestrol, when administered for a sufficient period, acts as a cocarcinogen in mice, accelerating the induction of uterine tumors by 20-methylcholanthrene and perhaps stimulating their growth. Preliminary data are presented for a study of the effect of weekly doses of \times radiation on the organ weights of growing mice. (C.H.)

2728

Argonne National Lab.

RADIOBIOLOGY EXPERIMENT STATION, RADIOCHEMISTRY, PHYSICAL CHEMISTRY, PHARMACOLOGY, THEORETICAL BIOLOGY, AND BIOPHYSICS. John F. Thomson, E. T. Mikuta, George A. Sacher, Robert E. Rowland, and Herbert E. Kubitschek. p.41-71 of QUARTERLY REPORT [FOR] AUGUST, SEPTEMBER, AND OCTOBER 1952; DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH. Austin M. Brues, ed. 31p. (ANL-4932(p.41-71))

The conversion of C^{14} -labeled dextran to crystalline glucose with acid hydrolysis, and the biosynthesis of C^{14} -labeled sucrose by *Canna* leaves are reported. Preliminary attempts to biosynthesize C^{14} -labeled rutin by buckwheat are discussed. Studies are reported of the response of floral initiation in *Xanthium* to photoperiod, growth response of plants cultured with enriched levels of N^{15} , and methods of assay for natural plant growth regulators. Preliminary findings indicate that intestinal Ca levels are associated intimately with blood Ca levels. The excretion and tissue distribution of radioberyllium following injection of either salicylic acid or sulfosalicylic acid were studied in an attempt to explain differences in protection of mice poisoned acutely by Be sulfate. Preliminary results are discussed.

Results of a study indicate that total-body irradiation does not affect the capacity of rats to acetylate *p*-aminobenzoic acid. Preliminary results from a study of hormonal factors governing the response of rat liver tryptophan peroxidase-oxidase to total-body irradiation indicate some of the increase in TPO is independent of the pituitary. A photograph of a continuous microorganism culture apparatus and a wiring diagram for a drop-counting register circuit for use with the apparatus are included. Preliminary results are summarized from a study of radiation effects on respiration of *E. coli*. Problems encountered in preparing microradiographs are discussed and methods for the preparation of satisfactory microradiographs of undecalcified bone sections ranging in thickness from 70 to 130 μ are described. (C.H.)

2729

Air Force Radiation Lab., Univ. of Chicago

QUARTERLY PROGRESS REPORT NO. 6. Jan. 15, 1953. 70p. (NP-4447)

Preliminary studies show a slight increase in adenosine triphosphatase activity of the spleen and thymus gland in mice following administration of 25 r \times radiation, with proportionally greater increases resulting from higher doses. Mechanisms are discussed which may be responsible for reduced intestinal cholinesterase activity observed in rats, mice, and ground squirrels following \times irradiation. Studies of the effect of central nervous stimulants on the response of rats to \times irradiation have been continued and additional drugs have been tested. The 5-nucleotidase activity of rat spleen and thymus tissues was found to be increased after doses of total-body irradiation ranging from 100 to 400 r. Other tissues from irradiated animals did not show this increase. A new type of animal board is described on which swine or other animals of similar size may be quickly restrained and quickly released. Preliminary studies of injections of swine liver catalase as a protective agent against radiation damage in swine showed inconclusive results. Data presented show that thin lead foil covering the abdomen is highly effective in reducing mortality of rats after whole-body irradiation. An apparatus is described for measuring the duration of a constant-intensity heat stimulus required to produce a response when applied to a rat's tail. Blood catalase activity measured just before exposure was found to give no index to susceptibility of mice to \times radiation at 800 r, 250 kr. After exposure to radiation, the catalase activity per unit volume of blood appeared to decrease slightly within a few days, whereas the ratio of activity to hemoglobin appeared to increase slightly. No prediction as to early or late death could be made from the measurement of individual weight losses of irradiated mice. Prophylactic effects of various chemical agents were tested in mice, and diphenylamine, *p*-hydroxydiphenyl plus *p*-aminopropiophenone, and antabuse plus ethanol were found to exert some degree of protective effects against the lethal effects of 800 r total-body \times irradiation. (For previous quarter see NP-4247) (C.H.)

2730

Atomic Energy Project, Western Reserve Univ.

QUARTERLY PROGRESS REPORT [FOR] JULY, AUGUST, [AND] SEPTEMBER 1952. 9p. (NYO-4027)

Very brief statements are made regarding the various studies. Nembutal increased the protection afforded by cysteine against radiation damage in rats and mice. The toxicity of colloidal Au^{198} administered to rats by the intraperitoneal route was found to be as great as when administered intravenously. The 30-day LD_{50} values for P^{32} as Na_2HPO_4 and colloidal Au^{198} in mice were found to be approximately 6 and 24 $\mu\text{c/g}$, respectively. CaCl_2 , MgCl_2 , formate, and tetraethyl ammonium did not alter the mortality rate in mice following exposure to whole-body

irradiation, while some protection was afforded by injected thiosorbitol and by injected sorbitol. It was demonstrated that in the mouse the spleen plays an important part in survival following whole-body irradiation only if it had been shielded. Preliminary investigation showed that cysteine increased the lethal effects of irradiation in Murphy sarcoma-bearing rats by reducing the sensitivity of the tumors to radiation. Studies in rats show that the lethal effects of total-body x irradiation in rats can be decreased by fractionation of the radiation dose. Data show a reduction in thyroid uptake of radioiodine in rats when water alone, or water and food, are allowed within the few hours following the dose. The effect of x irradiation on nucleic acid synthesis in chick embryos was studied by measuring the incorporation of formate-C¹⁴ into the purines and pyrimidines and preliminary data are presented. The average survival of irradiated dogs treated by cross transfusion were not significantly different than irradiated control animals, regardless of the amount of blood exchanged or the time selected for the procedures. No protection was afforded irradiated dogs by perfusion of blood through a donor spleen. (C.H.)

2731

Tennessee Univ.
QUARTERLY PROGRESS AND WORK ACCOMPLISHMENT REPORT FOR QUARTER ENDING DECEMBER 31, 1952; AGRICULTURAL RESEARCH PROGRAM. [nd] 152p. (ORO-90)

The work reported on Pa²³¹ includes the purification for biological use from neutron-irradiated Th nitrate; radiochemical properties of importance in biological measurements; absorption, tissue distribution, retention and fetal transfer in rats; adsorption, behavior in blood, secretion in milk, and tissue distribution in dairy cattle, sheep, and pigs; and a discussion of data from these studies from the standpoint of ingestion of food products from animals exposed to Pa²³¹. Preliminary results from a study of the effects of estrogen on Ca behavior in blood and bone, Ca and P blood levels, and bone histology in cattle show that moderate levels of α estradiol caused bone and urinary Ca changes, while high levels caused decreased serum Ca with concomitant serum P increases. Procedures and results are presented for the determination of endogenous fecal Ca in cattle by a simple isotope-dilution method which allows estimation of the true digestibility of Ca. Results are presented from a study of the availability for plant uptake and the leaching from soil of Ca incorporated therein as Ca⁴⁵-labeled Ca silicate. The LD_{50/30} value for burros exposed to whole-body irradiation was recalculated and was determined to be 651 r for γ radiation from Ta¹⁸² sources and 784 r for γ radiation from Co⁶⁰ sources. The LD_{50/30} for swine exposed to total-body γ radiation from Co⁶⁰ sources was determined as 618 r. The LD_{50/30} for rabbits exposed to total-body irradiation from Co⁶⁰ sources was determined to be 1094 r. Detailed blood value changes in the burro following irradiation and a statistical analysis of the data are included. (C.H.)

2732

Atomic Energy Project, Univ. of Calif., Los Angeles
A COMPARISON OF THE PULMONARY EDEMA PRODUCED IN PREDRUGGED MICE BY AIR BLAST INJURY AND BY THE ADMINISTRATION OF EPINEPHRINE. B. Casen, K. Kistler, and W. Mankiewicz. Feb. 24, 1953. 15p. (UCLA-245)

Several adrenergic blocking drugs, very effective in preventing acute pulmonary edema produced by the administration of epinephrine to mice, have in identical dosages no observable effect in reducing about the same level of edema produced by exposing the mice to air blast. Both types of

edema could be greatly reduced by preadministration of some cholinergic drugs. Both blast and epinephrine edema are enhanced in bilaterally vagotomized mice. The protective effects of the cholinergic drugs on both types of edema and that of the adrenergic blockers on epinephrine edema are still present after vagotomy. (auth)

2733

Atomic Energy Project, Univ. of Calif., Los Angeles
THE EFFECT OF X-IRRADIATION ON SERUM POTASSIUM AND SODIUM LEVELS IN RABBITS. Raymond D. Goodman and Marcus Vogel. Mar. 10, 1953. 14p. (UCLA-248)

Twenty-nine healthy rabbits were exposed to acute whole-body x irradiation in dosages ranging from 600 to 850 r. Serial determinations of their serum K and Na concentrations were made. None of the deaths occurring from either radiation shock or radiation sickness could be attributed to a significant change in these serum electrolytes. In several instances a high serum K was noted at the time of death in rabbits dying from radiation shock. This appeared to be a terminal event, rather than an etiologically related phenomenon. (auth)

2734

SYMPOMATIC DISTURBANCE AFTER SINGLE THERAPEUTIC DOSE OF X RAYS; ITS RELATIONSHIP TO THE GENERAL RADIATION SYNDROME. W. M. Court Brown. Brit. Med. J. I, 802-5(1953) April 11.

The pattern of symptoms following a single therapeutic dose of x rays has been described, based on the findings in a group of 50 patients. The pattern was found to consist of three well-defined phases: a latent period extending from the administration of the x rays to the onset of symptoms; a period of acute disturbance which persisted for between approximately 1 1/2 and 4 hr after the onset of symptoms, depending on the degree of upset; and a recovery period which in the most acutely disturbed patients extended over four to 5 days. The similarity between the pattern of symptoms following therapeutic doses of x rays and the symptoms of the period of initial reaction of the general radiation syndrome has been stressed, and attention has been drawn to the possible value of using clinical studies based on single therapeutic doses of x rays to interpret what may occur when, either accidentally or under conditions of war, much higher doses are received. (auth)

2735

BIOCHEMICAL ASPECTS OF THE PLANT INJURY CAUSED BY IONIZING RADIATIONS. L. Ehrenberg, A. Gustafsson, and N. Nybom. Acta Chem. Scand. 6, 1554-5(1952)

Seeds were found to be 20 to 30 times more sensitive to fast neutrons than to x radiation, when equal doses are given. The difference between the radiation sensitivities to neutrons of dormant and germinating seed was found to be 1/2 to 1/3 of the corresponding difference in the case of x radiation. It is concluded that the difference in behavior is probably related to the difference in ionization densities produced in tissue by neutrons and x radiation. (C.H.)

2736

TRANSBRONCHIAL INSTILLATION OF RADIOACTIVE GOLD COLLOID IN THE LUNG OF THE DOG; DISTRIBUTION STUDIES, SURVIVAL AND PATHOLOGY. George R. Meneely, Stewart H. Auerbach, Clarence C. Woodcock, Ross C. Kory, and Paul F. Hahn. Am. J. Med. Sci. 225, 172-7(1953) Feb.

The distribution of radioactive colloidal Au solutions instilled into the lung of dogs via the tracheo-bronchial route, and the pathological alterations produced by the resulting internal radiation following various dosages are described. (C.H.)

RADIATION HAZARDS AND PROTECTION

2737

Army Medical Research Lab., Fort Knox

STUDIES ON THE PROTECTIVE ACTION OF SULFHYDRYL COMPOUNDS AGAINST X-IRRADIATION. W. H. Parr, N. Puckett, R. Ransom, S. Spradling, and A. Krebs. Nov. 12, 1952. 19p. (AMRL-102)

Experiments show that the inhibiting effect of x rays on nucleic acid synthesis in intestinal mucosa of the albino rat can be influenced by pretreatment of the animal with cysteine. In connection with other investigations, it may be concluded that the protective action of cysteine involves such vital processes as the nucleic acid cycle. If cysteine affords its protection by other means than by a purely shielding effect, the mechanism of the effect must be an indirect one. (auth)

2738

Johns Hopkins Univ.

RADIOACTIVE CONTAMINATION AND DECONTAMINATION TESTS ON RUBBER GLOVES: PROGRESS REPORT. A. P. Talboys and S. S. Copp. Dec. 15, 1952. 21p. (NYO-4519; JHUL-2)

Natural- and synthetic-rubber gloves were exposed to solutions of P^{32} , I^{131} , and Sr^{89} . Rate and extent of adsorption of the various isotopes varied with the time of contact, pH, temperature, roughness of surface, and concentration of isotope. Surgeon's gloves and medium-weight latex gloves were found to be somewhat less susceptible to contamination than were neoprene and low-quality canner's gloves. Surgeon's gloves were most readily decontaminated, and ordinary anionic detergent and Versene solutions were consistently the most effective of the decontaminating agents tried. Agitation of the samples for 15-min periods in the solutions was considerably more effective than simple immersion, and almost as effective as scrubbing. Of the three isotopes investigated, I^{131} proved most difficult to remove. (auth)

2739

MECHANISMS OF PROTECTION AGAINST MAMMALIAN RADIATION INJURY. Austin M. Brues and Harvey M. Patt. *Physiol. Revs.* 33, 85-9 (1953) Jan.

Review.

RADIATION SICKNESS

2740

NATURALLY OCCURRING INFECTIONS IN UNTREATED AND STREPTOMYCIN-TREATED X-IRRADIATED MICE. Leon Gonschery, Robert Q. Marston, and Willie W. Smith. *Am. J. Physiol.* 172, 359-64 (1953) Feb.

Additional evidence of the influence of infection on lethality following radiation is demonstrated in the shortening of the survival time of animals showing certain types of infection at death. Deleting the animals that showed positive cultures at death resulted in an essentially linear relation between dose and time to death in the dose range 800 to 550 r. Infections were rarely observed in mice that died about 3.5 days after irradiation (1400 and 1100 r) and were most frequently observed in animals that died after 6 to 9 days, with the incidence reduced in those that died in the 3rd week after irradiation. With streptomycin treatment, although there was not always a significant reduction in mortality, there was always a reduction in the number that showed positive blood cultures and an increase in those showing negative cultures at death. Streptomycin treatment resulted in a prolongation of survival time which was independent of the presence of organisms in the blood at death. (auth)

2741

PROPHYLACTIC ANTIBIOTIC THERAPY IN X-IRRADIATED ANIMALS. Willie W. Smith, Falconer Smith, H.

Jeanette Ruth, Harry Y. Canter, and Marie M. Grenan. *Am. J. Physiol.* 172, 351-8 (1953) Feb.

Streptomycin treatment following irradiation in mice gave favorable survival results in about half of the weaning batches studied over a period of 16 months. Treatments with other antibiotics and results with rats and guinea pigs were less favorable. Weight changes of successfully treated mice are shown. Streptomycin blood levels and LD_{50} were essentially the same in irradiated and control mice. The incidence of diarrhea was reduced in rats treated with streptomycin or terramycin, but not with penicillin. (auth)

2742

EXPERIMENTAL INFECTION AND STREPTOMYCIN TREATMENT IN IRRADIATED MICE. Robert Q. Marston, Leon Gonschery, Ilo M. Alderman, and Willie W. Smith. *Am. J. Physiol.* 172, 365-71 (1953) Feb.

Of eight organisms tested, all but the two strains of *α*-streptococcus resulted in increased mortality in mice x-irradiated with 475 r. Streptomycin was effective with *Staph. aureus*, partially effective with *Paracolon*, *E. coli* and *Proteus*, and ineffective with *Pseudomonas* infections. With *Proteus* *Kf*, streptomycin reduced mortality only during the first 2 days after infection, although in both early and late periods there was a reduction in the incidence of positive, and an increase in negative blood cultures. Treatment for 3 days with 1.25 mg of streptomycin per day was almost as effective in reducing mortality (though not as effective in reducing the incidence of positive blood cultures) as longer treatment with 2.5 or 5 mg twice a day. Susceptibility to *Proteus* showed no further increase, nor did the efficacy of streptomycin show a decrease, from the 3rd through the 12th day after irradiation with 475 r. After a radiation dose as low as 250 r the animal still showed marked susceptibility to *Proteus* infection. Streptomycin was more effective at 250 r than at 475 r. (auth)

RADIOGRAPHY

2743

[Wisconsin Univ. Medical School] AN ACCURATE REFERENCE SYSTEM FOR HISTORADIOGRAPHY. [J. J. Clemons and T. C. Webster.] [1952] 9p. (AECU-2468)

A simplified method of preparing the reference system for qualitative historadiography has been described. The method is based upon measuring light absorption of dyed Parlodion wedges. The procedure is quick, accurate and requires no apparatus other than the microdensitometer required for density measurements on the historadiograph. (auth)

2744

Wisconsin Univ. Medical School THE TECHNIQUE OF QUANTITATIVE HISTORADIOGRAPHY. J. J. Clemons, J. J. Lalich, and D. M. Angevine. [1952] 15p. (AECU-2469)

The methods and instruments required for determining the mass (10^{-12} to 10^{-13} g) of a single cell in situ are described. Like the analytical balance, historadiography cannot solve a problem, but it may be extremely valuable when used with other methods. The data obtained must be interpreted carefully and the conclusions drawn increase in importance when correlated with other histochemical or biochemical methods. It does not surmount any of the older techniques but serves to increase their usefulness and possibly place some qualitative techniques on a more quantitative basis. (auth)

TOXICOLOGY STUDIES

2745

Los Alamos Scientific Lab.

COMPARATIVE BIOLOGICAL EFFECTS OF URANIUM²³⁵

AND URANIUM²³⁸ (NORMAL URANIUM): RENAL FUNCTION STUDIES. W. J. Eversole. Jan. 10, 1953. 25p. (LA-1333)

Renal function tests reveal that either U²³³ or normal uranium (U²³⁸), in a dose of 1 mg/kg body weight causes severe damage to the kidneys. Following an initial period of equal impairment by U²³³ or U²³⁸, kidney function in animals given U²³³ returns toward normal more slowly than in animals given U²³⁸. Evidence presented indicates that the toxicity of U²³³ is a result of its chemical rather than its general radiation effects on the kidney. (auth)

2740

National Bureau of Standards:
THE BIOLOGICAL EFFECTS OF DEUTERIUM COMPOUNDS. Harold J. Morowitz and Lawrence M. Brown. Jan. 14, 1953. 50p. (NBS-2179)

A literature survey of biological effects of D compounds is presented. References include effect of D₂O on mice, other mammals, isolated organs and tissues, tumor tissues, higher plants, bacteria, yeasts, molds, protozoa, and algae. 216 references. (L.T.W.)

2741

Trudeau Foundation, Saranac Lake, N. Y.

BIOCHEMICAL ASPECTS OF PULMONARY DISEASE OCCURRING IN BERYLLIUM WORKERS; PROGRESS REPORT, PART 2. Mar. 15, 1952. 9p. (NYO-4007)

Injection of Be salt was found to increase the formation of glycogen from glucose in rats. Results of experiments attempting to explain the mechanism of this reaction indicate that the primary disturbance caused by the acute intoxication by Be is an increase in protein break-down. A resulting increase in supply of amino acids leads to the formation of glycogen. No primary disturbance of carbohydrate metabolism was noted. A brief discussion is included on the use of purified morin reagents in the fluorimetric determination of Be. (For previous report in series see NYO-4006.) (C.H.)

TRACER APPLICATIONS

2742

Biophysical Lab., Harvard Medical School
THE SIMULTANEOUS DETERMINATION OF RED CELL MASS AND PLASMA VOLUME IN MAN WITH RADIOACTIVE SODIUM CHROMATE AND CHROMIC CHLORIDE. Seymour J. Gray and Heddy Frank. Biophysical Lab., Harvard Medical School and Peter Bent Brigham Hospital Medical Clinic, Boston. [1953] 16p. (AECU-2459)

Radioactive Na chromate and chromic chloride were employed in the simultaneous determination of both red cell mass and plasma volume in man. The mean values for red cell mass and plasma volume obtained by the combined method agree favorably with those obtained when radioactive Na chromate and chromic chloride are administered separately. (auth)

2743

Biophysical Lab., Harvard Medical School
THE DETERMINATION OF PLASMA VOLUME IN MAN WITH RADIOACTIVE CHROMIC CHLORIDE. Heddy Frank and Seymour J. Gray. Biophysical Lab., Harvard Medical School and Peter Bent Brigham Hospital, Boston. [1953] 22p. (AECU-2460)

Radioactive chromic chloride with a half life of 26.5 days was used for the determination of plasma volume in man. Using this method the circulating plasma volumes of 21 normal adult males were determined to be: mean circulating plasma volume, 2894 ± 366 ml; mean plasma volume/kg body weight, 39.3 ± 4.9 ml; and mean plasma volume/m² surface area, 1515 ± 157 ml. (auth)

2750

Radiation Lab., Univ. of Calif., Berkeley
THE PATH OF CARBON IN PHOTOSYNTHESIS. 18. THE IDENTIFICATION OF NUCLEOTIDE COENZYMES. J. G. Buchanan, V. H. Lynch, A. A. Benson, M. Calvin, and D. F. Bradley. Jan. 19, 1953. 24p. (UCRL-2074)

Uridine diphosphate glucose and uridine diphosphate galactose have been identified in green plants. The hexoses of these compounds become labeled rapidly during photosynthesis in C¹⁴O₂ and constitute a large fraction of the total labeled non-polysaccharide hexose. A mannose-containing compound chromatographically similar to a nucleotide is present. Evidence is presented for the presence of an adenosine-containing nucleotide other than adenosene di-, tri-, or monophosphate. (auth)

CHEMISTRY

2751

Argonne National Lab.

EFFECT ON METAL-METAL BONDS OF INCREASED CONCENTRATION OF HYDROGEN IN HAFNIUM DIHYDRIDE. S. S. Sidhu. Jan. 1953. 8p. (AECU-2443; UAC-711)

Tetragonal unit cell of hafnium dihydride is formed at a composition HfH_{1.87}. As the concentration of H atoms in the dihydride is increased, a₀ of the unit cell increases and c₀ decreases. For HfH_{1.88}, a₀ = 3.452 ± 0.002 Å, c₀ = 4.384 ± 0.002 Å, and c = 1.270; and for HfH_{2.10}, a₀ = 3.484 ± 0.003 Å, c₀ = 4.368 ± 0.003 Å, and c = 1.254. The metal-metal atom-distance increases from 3.281 to 3.291 Å. This is interpreted on the basis that H atoms form bridge bonds with metal-metal bonds. As the concentration of H atoms increases, more metal-H bonds are formed, and consequently the number of metal-metal bonds is lowered. Since the metal-metal bonds are in the (001) plane, there is an expansion of the unit cell in this plane and a compression at right angles to it, resulting in increased a₀ and decreased c₀. (auth)

2752

Argonne National Lab.

HEATS OF SOLUTION OF THE COBALTOUS CHLORIDE HYDRATES IN WATER AND CERTAIN ORGANIC SOLVENTS. Leonard I. Katzin and John R. Ferraro. Feb. 1953. 17p. (AECU-2445; UAC-714)

The heats of solution of cobaltous chloride and its hydrates in water and a number of oxygenated organic solvents are presented. Some relations to heats of solution of other salts are pointed out. (auth)

2753

Washington Univ., St. Louis

THE DEGRADATION OF PENTOSENUCLEIC ACIDS BY BASE-CATALYZED ALCOHOLYSIS (thesis). Jonathan Stanton Dixon. June 1953. 172p. (AECU-2456)

A method for degradation of ribonucleic acid was studied. Base-catalyzed methanolysis of yeast ribonucleic acid was studied and compared with base-catalyzed hydrolysis of the same ribonucleic acid. Hydrolysis gives 8 nucleotide fractions, and methanolysis gives 11 fractions. Base-catalyzed methanolysis is selective to certain nucleotide fragments. Evidence is presented indicating that the sugar moiety of adenylic acid in the intact molecule may be triply esterified to different phosphate residues. The methanolysis products are probably methyl esters of the nucleotides. All the nucleotide fractions produced during methanolysis contain methoxy groups. The hydrolysis and methanolysis degrada-

tion reactions are discussed in terms of a reaction mechanism involving the formation of a cyclic intermediate. The difference in reactivity of ribo- and desoxyribonucleic acids is discussed. End groups on the ribonucleic acid were studied. Dowex anion-exchange studies of methanolysis reaction mixtures indicate that chloride-column separation leads to methoxyl loss; formate-column separations proceed without methoxyl loss. Methods were devised for nucleotide separation from column effluent solutions. Chloride ion in HCl containing cytidylic or uridylic acids may be removed by Ag_2CO_3 and H_2S . Adenylic and guanylic acids may be precipitated as Cu salts from neutralized chloride-column effluent solutions. Suspension of the Cu salts in H_2O and reprecipitation of Cu ion with H_2S leaves only the nucleotide in solution. Nucleotides in formate-column effluent may be isolated by adsorption onto activated C. Analysis for P and methoxyl are performed on the adsorbed samples. Nucleotides are desorbed by shaking the C samples with aqueous alcohol. A method for determining vicinal hydroxyl groups in small amounts of nucleosides was devised. (L.T.W.)

2754

Northwestern Univ.
MECHANISM OF SUBSTITUTION REACTIONS IN COMPLEX IONS. 3. KINETICS OF AQUATION OF SOME COBALT(III) COMPLEX IONS. Ralph G. Pearson, Charles R. Boston, and Fred Basolo. [1952.] 12p. (AECU-2475)

Rates of aquation have been measured for a series of compounds of the type, $\text{trans-}[\text{Ce}(\text{AA})_2\text{Cl}_2]^+$, in which the steric properties of the bidentate (AA) group were varied. It was found that in almost every case an increase in size or steric crowding of the bidentate was accompanied by an increase in the rate of aquation. This has been interpreted as evidence for the five-coordinated intermediate of the SN_1 or dissociation mechanism, and against the seven-coordinated activated complex of the SN_2 or displacement mechanism. (auth)

2755

Illinois Univ.
DIFFUSION IN CS_2 —HYDROCARBON SYSTEMS UNDER PRESSURE. R. C. Koeller and H. G. Drickamer. [1951.] 38p. (AECU-2477)

Diffusion coefficients are presented as a function of pressure to 10,000 atm. for the following systems: 50 mole % n-heptane—50% CS_2 at 0, 20, and 40°C; 50 mole % 2,4-dimethylpentane—50% CS_2 at 20 and 40°C; 50 mole % toluene—50% CS_2 at 20 and 40°C; 50 mole % methylcyclohexane—50% CS_2 at 0, 20, and 40°C; and 50 mole % n-octane—50% CS_2 at 20°C, using S^{35} -tagged CS_2 . The results are interpreted in terms of the activation volume, enthalpy, and entropy, and conclusions are drawn concerning the effect of pressure on the structure of the liquids. (auth)

2756

Illinois Univ.
THE EFFECT OF PRESSURE ON SELF-DIFFUSION IN CARBON DISULFIDE. R. C. Koeller and H. G. Drickamer. [1951.] 26p. (AECU-2478)

A method has been developed for measuring diffusion coefficients in liquids to 10,000 atm. pressure. Measurements have been made over this pressure range at 0, 20, and 40°C for the system $\text{CS}_2\text{-CS}^{35}$. The results are interpreted in terms of the enthalpy, entropy, and volume of activation as a function of the temperature and pressure. (auth)

2757

Illinois Univ.
THE EFFECT OF PRESSURE ON DIFFUSION IN AQUEOUS SULFATE SOLUTIONS. R. B. Cuddeback, R. C. Koeller, and H. G. Drickamer. [1951.] 25p. (AECU-2479)

Diffusion coefficients have been measured as a function of pressure to 10,000 atm. at 0, 25, and 50°C for the systems 0.1N Na_2SO_4 , 1N Na_2SO_4 , and 0.1N K_2SO_4 . The results are discussed with the aid of the activation volume concept and compared to previous data for self-diffusion in H_2O . In general, the effect of the H_2O structure is controlling, with some added effects due to solvation and ionic interaction. (auth)

2758

North American Aviation, Inc.

A COMPILATION OF VAPOR PRESSURE DATA FOR THE ELEMENTS FROM Br TO U, AND THEIR OXIDES AND CARBIDES. W. R. Martini. Dec. 30, 1952. 44p. (NAA-SR-215)

This report is a compilation of vapor pressure data, taken from available literature, for elements in the periodic table from Br to U, and also for the oxides and carbides of these elements. The vapor pressures are plotted as $\log P$ vs. $1/T$ on a scale large enough to be conveniently usable. When the vapor pressure at only one temperature was available for a substance, the "point of convergence" was used as the second point on which to base the graph. This point of convergence was given as 10,000 atm. and 10,000°C. If two sets of data appeared comparably reliable, both were plotted. In addition to the vapor pressure charts, the following data have been tabulated for the elements, oxides and carbides: melting point, boiling point at 760 mm Hg, standard free energy of formation (for the compounds), and the range of temperature over which vapor pressures are known. The tables are cross-referenced to the charts. The free energy-temperature equations have also been included. (auth)

2759

Electrochemistry Research Lab., Western Reserve Univ.
THE CATHODIC POLARIZATION ASSOCIATED WITH THE OXYGEN ELECTRODE. Ernest Yeager, R. R. Witherspoon, Herman Urbach, and Frank Hovorka. Mar. 15, 1953. 27p. (NP-4479; Technical Report 2)

Cathodic polarization measurements have been made by the commutator technique with O on partially water-proofed active C electrodes in alkaline solution. These measurements indicate that even at appreciable current densities, the electrochemical conversion of adsorbed O to the perhydroxide ion is essentially reversible. The rate-determining steps are primarily associated with the conversion of gas-phase O to adsorbed O and the removal of excess perhydroxide ions from the solution-electrode interface through diffusion, electrolytic transport, and/or decomposition. (auth)

2760

Pennsylvania Univ.
HETEROGENEOUS CATALYSIS: PROGRESS REPORT. K. A. Krieger. Mar. 25, 1952. 11p. (NYO-746)

The decomposition of NH_3 over Cu occurred at measurable rates only at temperatures so high (~475°C) that the catalyst was unstable and crystal growth occurred. The decomposition of NO over Cu and platinized silica gel required temperatures of over 300°C on Cu and near 530°C on Pt. The oxidation of CO over Cu begins below 200°C. A first-order activation energy of ~3 kcal/mole was calculated for this system. Hydroxyl radicals produced in the electric discharge through water vapor react on silica gel and produce a rise in temperature of the gel and a greenish luminescence. The glow phenomenon and temperature rise are sensitive to the presence of impurities. A plot of glow intensity vs. temp. of heating gives indication of maximum activity between 200 and 400°C. (L.T.W.)

2761

Pennsylvania State Coll. School of Chemistry and Physics
POSSIBLE ISOMERS FOR COORDINATION COMPOUNDS

WITH TERDENTATE LIGANDS AND LIGANDS OF HIGHER FUNCTION. W. Conard Fernelius and Burl E. Bryant. Nov. 24, 1952. 8p. (NYO-3631)

The isomeric forms for six-coordinate entities with terdentine groups and groups of higher function were worked out by means of models and are tabulated. Optical activity originating within the coordinating groups was disregarded. The assumption was made that adjoining points of attachment on the coordinating groups will always be in the closest adjacent positions in the coordination sphere of the metal. (L.T.W.)

2762

Yale Univ.

TRACER-DIFFUSION IN LIQUIDS. 4. SELF-DIFFUSION OF CALCIUM ION AND CHLORIDE ION IN AQUEOUS CALCIUM CHLORIDE SOLUTIONS. Jui Hsin Wang. Nov. 15, 1952. 8p. (NYO-3872)

The self diffusion coefficients of Ca^{++} and Cl^- in aqueous CaCl_2 solutions at 25°C were measured by the improved capillary method using Ca^{45} and Cl^{36} as tracers. A plot of the diffusion coefficients D vs. \sqrt{c} , where c is the concentration in formular wts./liter gives a linear relationship and as the concentration of the CaCl_2 solution decreases continuously to zero, the self-diffusion coefficients of both Ca^{++} and Cl^- appear to approach the Nernst limiting values above two straight lines representing Onsager's equation. (L.M.T.)

2763

Columbia Univ.

REACTIONS OF IODINE ATOMS IN SOLUTION: ANNUAL PROGRESS REPORT. Richard M. Noyes. Dec. 1, 1952. 16p. (NYO-3881)

Studies of the photochemical behavior of hexane solutions containing I and allyl iodide confirmed the production of I previously predicted. Quantitative measurements confirm previous, less direct estimates of the quantum efficiency for production of I atoms that escape from their original partners. A study of the exchange of sec-butyl iodide with I to show the mechanism of attack of I atoms on alkyl iodides was initiated. Studies of the kinetics of the thermal exchange between benzyl iodide and I indicate a mechanism not previously observed. Apparently the dissociation of benzyl iodide molecule at 80°C is almost as probable as the dissociation of an I molecule, and both dissociation reactions serve to initiate chains. A study of the exchange between I and iodobenzene was started. Theoretical studies have suggested a new approach to the kinetic treatment of quenching of fluorescence and other diffusion-controlled reactions. (auth)

2764

Radiation Lab., Univ. of Calif., Berkeley

PHOTOSYNTHESIS (THE PATH OF CARBON IN PHOTOSYNTHESIS AND THE PRIMARY QUANTUM CONVERSION ACT OF PHOTOSYNTHESIS). Melvin Calvin. Nov. 22, 1952. 31p. (UCRL-2040)

This constitutes a review of the path of C in photosynthesis as it has been elaborated through the summer of 1952, with particular attention focused on those aspects of C metabolism and its variation which have led to some direct information regarding the primary quantum-conversion act. An introduction to the arguments which have been adduced in support of the idea that chlorophyll is a physical sensitizer handing its excitation on to thioctic acid, a compound containing a strained 1,2-dithiolycyclopentane ring, is given. (auth)

ANALYTICAL PROCEDURES

2765

Knolls Atomic Power Lab.

DETERMINATION OF MICRO

GRAM AMOUNTS BY ALCOHOL EXTRACTIONS. J. Rynasiewicz, Muriel P. Sleeper, and J. W. Ryan. Issued Sept. 21, 1950. Decl. Mar. 13, 1953. 6p. (AECD-3511; KAPL-405)

A weighed Na sample (~2g) is cut into pea-sized pieces and dissolved in water in a quartz flask purged with a continuous stream of N_2 . The alkaline solution is cooled and nearly neutralized with HCl. The solution is transferred to a Pt dish and evaporated to dryness. The aggregated NaCl crystals are broken up and acidified. The B is extracted with ethyl alcohol, the solution is decanted into a centrifuge tube, and the extractions are repeated with 2 more portions of alcohol made acid with 10% HCl. The extracts are centrifuged, transferred to a Pt dish, and neutralized with NaOH. NaOH and a glycerol-methanol solution are added, evaporated to dryness, and then ignited. The Pt dish is cooled and a curcumin solution and an oxalic acid-HCl solution are added. The dish is heated with the palm of the hand, and the viscous mixture is rotated until the salt dissolves. The dish is floated on a water bath at 60°C for 10 min in excess of the complete evaporation period. The residue is extracted with ethyl alcohol, shaken well, centrifuged, decanted, and the absorption measured at 550 m μ with a colorimeter, using air as 100% transmission. The B is calculated from a standard curve. (L.T.W.)

2766

Knolls Atomic Power Lab.

DETERMINATION OF OXYGEN IN CHROMIUM BY THE VACUUM FUSION METHOD. W. S. Horton and J. Brady. Feb. 1953. 23p. (KAPL-874)

A method for investigating the effects of operating temperature and metal bath composition upon the recovery of oxygen by the vacuum-fusion method is presented and exemplified by application to Cr. This method consists of using mixed powders containing metal and metal oxide, determining the O at various operating temperatures, and allowing the concentration of the sample metal to increase in the bath. The results are fitted by the method of least squares to an equation of the form:

$$R = a + c_1 C + c_2 C^2 + t_1 T + t_2 T^2 + kCT,$$

where a, c_1 , c_2 , t_1 , t_2 , and k are the fitted constants, R is the recovery equal to $100 \times (\text{O found})/(\text{O expected})$, C is the weight per cent of chromium in the bath, and T is the operating temperature. For chromium, much better results were obtained by using a molten bath of 75% Fe and 25% Sn by weight than by using a bath of pure Fe. At 1600°C the method with this type of bath gave about 85% recovery of O when no Cr was present. When the samples had increased the Cr to about 5% of the bath, the O recovery dropped to about 70%. The results were checked by modification of an acid solution method. Cr annealed at 800°C in vacuum was dissolved in 1.2N HCl. The insoluble residue was fused with potassium persulfate and potassium hydroxide in a nickel crucible. Dissolved in water, the fusion mixture gave a solution of potassium chromate in proportion to the undissolved chromic oxide. The latter was measured colorimetrically. Powders appeared to give better results with the vacuum fusion method when wrapped with Al foil and Fe wire rather than when placed in Ni capsules. (auth)

2767

National Bureau of Standards

DETERMINATION OF CARBON-14 IN THE TERMINAL POSITIONS OF SUGARS: ASSAY OF D-FRUCTOSE-1,6-C¹⁴. Harriet L. Frush and Horace S. Isbell. Mar. 2, 1953. 11p. (NBS-2308)

Proof of the structure of D-fructose-1,6-C¹⁴ is described, and methods developed for determining C¹⁴ at the terminal positions are reported. A convenient procedure was

developed for crystallization of fructose from crude sirups, consisting of dehydration of the sugar sirup by azeotropic distillation with absolute ethanol, followed by solution in methanol, and addition of a higher alcohol to the point of turbidity. For assay of position one, the method chosen was an alkaline degradation of the sugar in the presence of O adapted to a semimicro scale and conducted to avoid contact of the sugar and alkali except under O pressure. The resulting arabonic acid was conveniently separated as crystalline K arabinate, and the assay of position one of the labeled fructose was obtained from the difference in activity of the sugar and K salt. For the assay of position 6 of fructose, the K arabinate was oxidized with NaIO_3 , and the formaldehyde was isolated by means of the dimedone compound. The methods for fructose assay can be used without change for assay of glucose and mannose. A method is given for preparing D-arabinose-5-C¹⁴. (L.T.W.)

2768

Department of Mines and Technical Surveys, Mines Branch, Ottawa (Canada).

USE OF 2,2-DIQUINOLYL IN THE COLORIMETRIC DETERMINATION OF COPPER IN MINERALS AND ORES. R. J. Guest. Dec. 9, 1952. 15p. (NP-4457; TR-105/52)

A colorimetric procedure for the determination of Cu with 2,2-diquinolyl (cuproine) is described. The method is based upon the fact that cuproine forms an intensely colored purple complex with cuprous ions, the color of the complex bearing a linear relation to the Cu present. The reagent is specific for monovalent Cu. Ions which are themselves colored do not interfere as the Cu-cuproine complex is extracted with amyl alcohol from a weakly acid solution. The effect of pH and shaking time on the extraction was found to be important. Optimum conditions for complete extraction of the complex are indicated. The method, being very rapid and simple in execution, is especially suited for routine work. (auth)

2769

Institute of Industrial Research, Syracuse Univ.

THE APPLICATION OF STRONG CHELATING AGENTS IN THE SEPARATION OF THORIUM AND THE RARE EARTHS, FOR PERIOD JANUARY 1, 1952 TO SEPTEMBER 30, 1952. Louis Gordon and Kenneth J. Shaver. Oct. 29, 1952. 104p. (NYO-3555)

A concentration method for application on a macro-scale is given for the separation by precipitation of 98 to 100% of the rare earths (as typified by Ce) in the presence of phosphate and Th. The rare earths removed are contaminated with Th to an extent of 2 to 4%. The method involves the precipitation of phosphate-free rare-earth oxalates in the presence of the chelating agent, ethylenediaminetetraacetic acid (EDTA). Other precipitants and related complexing agents were also investigated and are shown to be of limited application. A method is given for the removal of trace quantities of rare earth from Th, Ce present in Th to the extent of 0.5 mg or less per g of Th can be 90 to 99% removed in a single operation. The method involves the precipitation of oxalates in the presence of the chelating agent, nitrilo triacetic acid. An improved procedure is given for the fractionation of rare earth oxalates complexed with EDTA. Results obtained with some rare-earth pairs of the Ce group in the presence of the chelating agent are compared with those obtained with a fractionation procedure utilizing methyl oxalate. The procedure involving Sequestrene was also applied to the separation of the Ce and Y groups. In the presence of this reagent, oxalate can be used to separate these two groups with an efficiency comparable to the double sulfate method. An improved method is given for the spectrophotometric determination of Ce(IV). The method is based on the ultraviolet absorption of Ce follow-

ing oxidation with alkaline H_2O_2 in the presence of EDTA. The interference by Th is discussed and is shown to have a negligible effect on the determination of 0 to 2 mg of ceric oxide per 100 ml when Th oxide is present in an amount less than 5 mg. (auth)

2770

ANALYSIS OF METALLIC IMPURITIES IN IRON OF HIGH PURITY BY PILE ACTIVATION. Philippe Albert, Michel Caron, and Georges Chaudron. *Compt. rend.* 236, 1030-1 (1953) Mar. 9. (In French)

Detection in pure Fe of Cu, Mn, Ni, Co, and As in concentrations of 1 to 10 ppm by pile activation is described briefly. (G.Y.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

2771

Cornell Univ.

STRUCTURES OF FLUOROCARBONS, ELEMENTARY BORON, AND BORON COMPOUNDS. J. L. Hoard. Apr. 1, 1953. 9p. (NYO-3943)

Accurate spectrometric measurement of the intensities of all (hk0) reflections obtainable with Mo K α radiation from a single crystal of tetragonal B has led to a sharply defined fourier projection of electron density on (001). Apart from one case of almost exact superposition of two atoms, the peaks in this projection are unusually well resolved. Deviations from the symmetry of the space-group P4/nmm, requiring (hk0) reflections with h + k odd to be absent, are practically negligible, although in principle one of the subgroups P4nm or P4n2, either of which would permit the few observed but extremely weak reflections with h + k odd to appear, is the correct choice. The small but definite deviations in the peak positions as between the new projection and that of the "ideal" structure (*J. Am. Chem. Soc.* 73, 1892(1951)) have definite implications in connection with the process of finding the z-parameters of the actual structure. The structural investigation of crystalline dimethylaminoborine dimer has reached an advanced stage. The minimum required molecular symmetry of the molecule 2/m requires the four-membered B-N ring skeleton to be flat, but would allow the rhomboid as the most general configuration. Whether the two B-N bond distances are significantly different and whether the bond angles depart appreciably from 90° has not yet been determined. Five fluorocarbons of formulas C_8F_{12} , $\text{C}_8\text{Cl}_4\text{F}_8$, C_4F_{10} , $\text{C}_4\text{Cl}_4\text{F}_4$, and $\text{C}_4\text{Cl}_2\text{F}_4$ have received considerable study. Excepting C_8F_{12} these compounds crystallize just below their melting points in the cubic (in one case the hexagonal) system. Symmetry considerations and the intensity distributions of both Bragg and diffuse scattering seem to require "molecular rotation" in the crystal. Study of the x-ray data provided by a single crystal of C_8F_{12} , the one compound not showing molecular rotation, has not been successful in achieving a determination of structure. (auth)

2772

Institute of Science and Tech., Univ. of Arkansas
STUDY OF RECRYSTALLIZATION OF ALUMINUM OXIDE: PROGRESS REPORT FOR THE PERIOD SEPTEMBER 15, 1952 THROUGH MARCH 15, 1953. W. J. Smothers and H. J. Reynolds. Mar. 15, 1953. 3p. (ORO-89)

Apparatus for vapor-pressure measurements is being redesigned to obtain the temperatures required. A sample of Ti_2O_5 which, as does TiO_2 , increases grain growth, was heated to 1700°C, and was found to consist of TiO_2 and TiO after it had been cooled. The addition of alkali-metal ions to alumina was found to retard the growth of grains. The fluoride ion was much more effective in this respect, even more than other halogen ions. The addition of Sb_2O_5 also decreased grain growth of alumina. Investigation of the

creation of defective structure in alumina during the process of transition from alumina hydrates has been undertaken. (auth)

2773

X-RAY-DIFFRACTION INVESTIGATIONS IN THE ZIRCONIUM-TIN AND ZIRCONIUM-LEAD SYSTEMS. H. Nowotny and H. Schachner. *Monatsh.* **84**, 189-80 (1953) Feb. 15. (In German)

The Zr-Sn and Zr-Pb systems containing up to 75 or 80 at.% Zr were studied by x-ray diffraction. In the Zr-Sn system, the intermediate crystal types $ZrSn_2$ and $ZrSn_{0.55 \pm 0.05}$ were established. $ZrSn_2$ crystallizes in the C54 structure with $a = 9.554$, $b = 5.633$, and $c = 9.907$ Å . The structure of $ZrSn_{0.55 \pm 0.05}$ is still not clear. In the Zr-Pb system, in addition to the components, the single phase Zr_5Sn_3 crystallizing in the D8₃ structure appears. The lattice constants are: $a = 8.512$, $c = 5.852$, and $c/a = 0.687$. (tr-auth)

DEUTERIUM AND DEUTERIUM COMPOUNDS

2774

SOME HEAVY WATER ROTATIONAL ABSORPTION LINES. C. K. Jen, D. R. Bianco, and J. T. Massey. *J. Chem. Phys.* **21**, 520-5 (1953) Mar.

Three new heavy-water rotational absorption lines have been observed in the microwave region. One of these lines and another line previously observed by McAfee have been identified as HDO lines by a study of the variation of their intensities with isotopic molecular concentration. By interpreting their Stark structure, the two HDO lines are assigned as follows: HDO: $8_{-1} \rightarrow 8_0$ at 24884.85 Mc and HDO: $6_{-2} \rightarrow 7_{-6}$ at 26880.47 Mc. In addition, results on the Zeeman spectra of the two identified HDO lines are presented. (auth)

FLUORINE AND FLUORINE COMPOUNDS

2775

THE MOLECULAR STRUCTURE OF CARBON TETRAFLUORIDE. C. W. W. Hoffman and R. L. Livingston. *J. Chem. Phys.* **21**, 565 (1953) Mar.

The length of the C-F bond in CF_4 (reported as 1.36 ± 0.02 Å in the literature) was remeasured because of the smaller values which have been determined for other fluoromethanes. Electron diffraction photographs were prepared of a CF_4 sample which was at least 99% pure. A camera distance of 107.61 mm was used and the electron wavelength was held practically constant at 0.0594 Å . The photographs were measured visually and resulting s_0 values for the maxima and minima when compared with those calculated from a tetrahedral model of CF_4 show good agreement. The C-F distance was determined as 1.31 , Å . (L.M.T.)

GRAPHITE

2776

ELECTRIC RESISTIVITY OF INTERSTITIAL COMPOUNDS OF GRAPHITE. S. Mrozowski. *J. Chem. Phys.* **21**, 492-5 (1953) Mar.

Assuming that the formation of interstitial compounds is accompanied by creation of excess holes in the otherwise full band of graphite, it is shown that a linear energy-momentum relation at the Brillouin zone corners is incapable of explaining the decrease of the electric resistance with oxidation. It appears that for a more general model the decrease in relative resistance should be independent of temperature for large oxidations if suitable corrections for the initial conditions are made. Data for polycrystalline graphite corrected for the existence of an energy gap and of excess holes in the untreated material give curves which

converge for higher oxidation with the curve for natural graphite. Discussion of the low temperature properties of graphite leads to the conclusion that large graphite crystals possess slightly overlapping zones. (auth)

RADIATION CHEMISTRY

2777

Atomic Energy Research Establishment, Harwell, Berks (England)

CHEMICAL DOSIMETRY AT HIGH DOSE RATES. N. Miller. Dec. 12, 1952. 9p. (AERE-C/R-1068)

By use of x rays from a 2-Mev Van de Graaff generator, it has been shown that the yield for the oxidation of ferrous ion in aerated $0.8\text{N} H_2SO_4$ solution is independent of dose rate up to at least 100,000 r/min. A further evaluation of the absolute yield of ferric ion at an average dose rate of 822 r/min gave a G value of 20.3 ± 1.0 . By comparison with the rate of ferrous ion oxidation, the G value for the reduction of ceric ion in similar solutions has been estimated to be 3.0 at 59,500 r/min. (auth)

2778

Rensselaer Polytechnic Inst.

DECOMPOSITION OF CARBON DIOXIDE BY IONIZING RADIATION; SEMI-ANNUAL REPORT. S. Dondes and A. J. Hogan. Mar. 1, 1953. 31p. (SO-3251)

A study of the decomposition of CO_2 by ionizing radiation has shown that the reaction of CO and ozone is not instantaneous, the thermal decomposition of ozone proceeds independently of the formation of CO_2 , increasing the surface area increases the rate of the reaction, nitric oxide decomposes ozone in the presence of CO without the formation of CO_2 , and the decomposition of nitrogen peroxide to yield O atoms photochemically, in the presence of CO, does not produce CO_2 . (C.H.)

RADIATION EFFECTS

2779

SOME EFFECTS OF COBALT GAMMA-RADIATION ON AQUEOUS BENZENE SOLUTIONS. Thomas J. Sworski. *J. Chem. Phys.* **20**, 1817-18 (1952) Nov.

Air-saturated aqueous benzene solutions and air-saturated H_2O were exposed to a Co γ -ray source giving an irradiation intensity of 2.33×10^{20} ev/liter/min. Rates of H_2O_2 and phenol production are graphed. A sharp break in the rate of phenol production occurs simultaneously with the onset of H_2O_2 disappearance. The phenol was determined by a spectrophotometric method using the difference in absorption of unbuffered and alkaline phenol solutions at 290 $\text{m}\mu$. This method minimizes interference due to those irradiation products that have no appreciable difference in such absorption spectra. (G.Y.)

SEPARATION PROCEDURES

2780

Institute for Atomic Research, Iowa State Coll. PAPER CHROMATOGRAPHY OF THE PHEOPHYTINS. S. Aronoff and Emil Kmetec. [1952] 9p. (AECU-2474)

A procedure is described for the separation of chlorophylls as to their respective pheophytins, and for the determination of microgram quantities of the pigments. (C.H.)

2781

DuPont de Nemours, E. I., and Co. Explosives Dept., Atomic Energy Div.

PERFORMANCE OF ION EXCHANGE RESINS AT HIGH FLOW RATES. J. R. Caddell and R. L. Moison. Mar. 1952. 39p. (DP-4)

With beds of mixed IR-120 and IRA-400 resins, increasing the flow rate from 5 to 100 gpm/ft² at any fixed level of influent impurities did not affect the capacity for producing

pure water with a specific resistance of 10^6 ohm-cm or better. Varying the influent concentration from 3 to 192 ppm, however, doubled the ion-exchange capacity expressed in terms of the impurities retained by the resins. (auth)

2782

Atomic Energy Project, Univ. of Calif., Los Angeles
STUDIES ON THE NEW HAMPSHIRE CHICKEN EMBRYO.
2. ULTRACENTRIFUGAL STUDIES OF THE SERUM
PROTEINS. Ole Arne Schjeide and Lee Deutsch. Feb. 25,
1953. 19p. (UCLA-246)

Quantitative separation of chicken-embryo serum proteins of low specific gravity from proteins of higher specific gravities was achieved by the combined use of a high-density medium and a specially devised partition cell for the Spinco preparatory ultracentrifuge. Sedimentation rates and relative concentrations of the dense protein components are presented as determined on the Spinco analytical centrifuge. (auth)

2783

PAPER CHROMATOGRAPHY OF INORGANIC IONS. V.
THE PREPARATION OF CARRIER-FREE ISOTOPES BY
PAPER CHROMATOGRAPHY. M. Lederer. Anal. Chim. Acta 8, 134-9 (1953) Feb. (In English)

Paper chromatography was employed for the separation of radioactive carrier-free isotopes from large amounts of inactive materials. The separations described are Na^{22} from Mg, Rh^{102} from Ru, Pd^{103} from Rh, Co^{60} from Fe^{55} , Zn^{65} from Cu, and U^{233} from Pa^{233} . (auth)

2784

SEPARATION OF SCANDIUM, LANTHANUM, AND
YTTRIUM. P. Radhakrishna. Anal. Chim. Acta 8, 140-5
(1953) Feb. (In French)

The behavior of Sc on an Amberlite IR-100-H resin has been studied, and an efficient separation of Sc, La, and Y has been effected using citric acid at different pH's. The hysteresis phenomenon which accompanies the adsorption of Sc and its importance for calculations based on the theory of levels are discussed. (auth)

SPECTROSCOPY

2785

Argonne National Lab.
THE SOLUTION CHEMISTRY OF NIOBUM AND TANTALUM.
2. SPECTRA OF SOME NIOBUM AND TANTALUM COMPLEXES. R. Elson. Feb. 1953. 8p. (UAC-712)

Qualitative and semiquantitative results obtained in the spectrophotometric study of Nb and Ta complexes are presented. Conventional methods were used, and the spectra of Nb complexes were determined over the range 210 to 400 m μ . Solutions of Nb in HClO_4 of varying acidity were studied to determine the spectra of the uncomplexed ions. Various anions were then added, at about constant salt strength, and the spectra were compared for changes which would indicate the formation of complex species. The chloride, tartrate, and fluoride systems were briefly studied. Molecular extinction coefficients of $\sim 5 \times 10^3$ to 5×10^4 were generally observed. Ta complexes were studied in the same manner. (L.T.W.)

SYNTHESSES

2786

National Bureau of Standards
FLUORINE SUBSTITUTION IN HYDROUS SILICATES AND
RELATED MINERALS: QUARTERLY REPORT FOR PERIOD
ENDING FEBRUARY 28, 1953. A. Van Valkenburg and G.
Rynders. Feb. 1953. 17p. (NBS-2394)

Work on fluorine substitution for hydroxyl in various hydrosilicates continued. During this quarter, 13 hydrothermal experiments were completed in the Tuttle apparatus

to determine the stability range of pyrophyllite and the possibility of substituting fluorine for hydroxyl in the pyrophyllite structure. Hydrothermal experiments were also continued on the synthesis of hydrogarnets and attempts were made to substitute fluorine for OH ions in the hydrogarnet structure. (auth)

2787

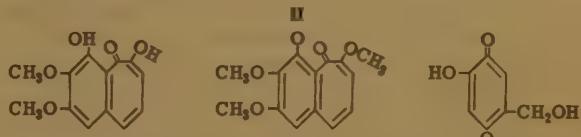
Pittsburgh Univ.
PROGRESS LETTER FROM OCTOBER 1, 1952 TO
DECEMBER 31, 1952. Robert Levine, Thomas F. McGrath, and Carl Osuch. Issued Jan. 23, 1953. 6p. (NYO-3383)

A study was made of the synthesis of α -substituted β -diketones and the use of NaH as a condensing agent in the reaction. The possibility of acylating the anion of propiophenone, prepared from the ketone and NaNH_2 , with acetyl chloride and acetic anhydride was under investigation. (J.E.D.)

2788

Pennsylvania State Coll. School of Chemistry and Physics
FORMATION CONSTANTS OF METAL COMPLEXES OF
TROPOLINE AND ITS DERIVATIVES. 3. DIMETHYL-
PURPUROGALLIN, 4,5-BENZTROPOLINE AND KOJIC
ACID. Burl E. Bryant and W. Conard Fernelius. Mar. 24,
1953. 13p. (NYO-3632)

Formation constants for several metal derivatives of dimethylpurpurogallin, 4,5-benztropolone, and kojic acid have been measured in 50% dioxane. It has been found that the metal complexes of none of these possess the unusual stability associated with the complexes of tropolone and its simple substitution products. As a continuation of the investigation of the tendency of tropolone and its derivatives to form coordination compounds with metal ions, the behavior of 4,5-benztropolone, purpurogallin and di- and trimethylpurpurogallin have been



dimethylpurpurogallin trimethylpurpurogallin kojic acid

studied. In an effort to estimate the effect of the size of the chelate ring formed in the coordination process, the coordination of the kojate ion was studied. (auth)

TRACER APPLICATIONS

2789

RADIOACTIVE MONOLAYERS: A NEW APPROACH TO
SURFACE RESEARCH. D. E. Beischer. J. Phys. Chem. 57,
134-8 (1953)

The study uses monomolecular layers prepared by the method of Langmuir and Blodgett (J. Am. Chem. Soc. 57, 1007 (1935)) to bring a limited supply of a reagent in the form of a homogeneous monolayer of C^{14} tagged stearic acid on the surface of different materials. The system is heated to a degree where chemical reaction of the coating material with the topmost layer of the surface takes place. The excess of the monolayer reagent is then removed and the distribution of the reaction product visualized in a radioautograph of the surface. The extreme sensitivity of this method allows localization and measurement of small differences in the chemical activity of a surface. (auth)

URANIUM AND URANIUM COMPOUNDS

2790

Oak Ridge National Lab.

DENSITY AND REFRACTIVE INDEX OF URANYL FLUORIDE

SOLUTIONS. James S. Johnson and Kurt A. Kraus. [1953.] Decl. Mar. 13, 1953. 5p. (AECD-3512)

In the course of ultracentrifugal investigation of uranyl fluoride solutions, their densities and refractive indices were measured as a function of concentration. The measurements were carried out near 25 and 30°C and, if necessary, extrapolated to 25 and 30°C from the observed temp. coefficients. Most density data were obtained pycnometrically and a few were obtained with gradient tubes. The refractive-index measurements were carried out with a Bausch and Lomb dipping refractometer (calibrated with "known" solutions) using Na-D light (reproducibility ± 0.00004). (auth)

ENGINEERING

2791

THE FLUID BEARING. Paul Gerard. Translated From J. Soc. Ing. Automobile 24, 135-8(1951). 10p. (NP-2412; ACSIL/ADM/52/189; ACSIL-Trans. No. 540)

HEAT TRANSFER AND FLUID FLOW

2792

Columbia Univ.

THERMAL CONDUCTIVITY OF DEUTERIUM OXIDE: [PROGRESS REPORT FOR] DECEMBER 1950-FEBRUARY 1951. Charles F. Bonilla and S. J. Wang, Columbia Univ. and DuPont de Nemours, E. L., and Co. Explosives Dept., Atomic Energy Div. 17p. (DP-12)

The thermal conductivity of D_2O was found to average about 97.3% of that of natural water over the range from 15 to 60°C. Several runs at different over-all temperature differentials were carried out with natural water in a double horizontal flat chamber apparatus, and the ratios of the thermocouple emf differences across the two chambers were obtained. These ratios of $\Delta E_{top}/\Delta E_{bottom}$ were then extrapolated to zero temperature differential. The same procedure was repeated using heavy water in one chamber and the ratio of the two extrapolated values of $\Delta E_{top}/\Delta E_{bottom}$ gave the ratio of the thermal conductivities of heavy and natural water. Details of the apparatus and data from a typical run are given. (auth)

2793

Carbide and Carbon Chemicals Co. (K-25)
PRESSURE CHANGES WITH THE FLOW OF WATER THROUGH TEES. J. E. Baker and J. W. Michel. Issued Mar. 16, 1953. 49p. (K-998)

Curves drawn from experimentally determined data, that may be used for accurate prediction of pressure drops resulting from the turbulent flow of noncompressible fluids through tees are presented. The curves should be applicable to any sized tee (90° tee branch) providing the branch pipe cross-sectional area to straight-through pipe cross-sectional area ratio lies between 0.25 and 1.0. Tests were conducted with total flows covering a range of Reynolds numbers from about 50,000 to 150,000. (Calculated for 2-in. pipe). Two general equations for splitting and combining flow proposed by A. Vazsonyi were investigated and found to apply only to special cases. It is demonstrated that the equations are applicable to only two of the four possible flow paths through a tee. Application of the experimentally determined data is demonstrated in the solution of typical flow problems. (auth)

2794

Langley Aeronautical Lab., NACA

EFFECT OF THERMAL PROPERTIES ON LAMINAR-BOUNDARY-LAYER CHARACTERISTICS. E. B. Klunker

and F. Edward McLean. Mar. 1953. 29p. (NACA-TN-2916)

An iteration method is presented for solving the laminar-boundary-layer equations for compressible flow in the absence of a pressure gradient wherein the temperature variation of all the fluid thermal properties is considered. Friction and heat-transfer characteristics have been calculated for a stream temperature of -67°F for Mach numbers from 1 to 10 with the use of values of the heat capacity, conductivity, and viscosity determined from experiment. Consideration of the temperature variation of all the fluid thermal properties causes the recovery factor to decrease substantially with increasing Mach number. Moreover, the heat-transfer rate is found to be proportional to the difference between an effective enthalpy, which is a function of both the surface temperature and stream Mach number, and the surface enthalpy. In contrast, the heat-transfer rate is proportional to the difference between the recovery enthalpy and the surface enthalpy for solutions which employ a constant Prandtl number. The calculated skin friction and heat-transfer rates based upon the use of the Sutherland equation for viscosity and a Prandtl number of 0.75, however, are in excellent agreement with the results of the present analysis. (auth)

2795

ON THE THEORY OF THE TURBULENT BOUNDARY LAYER. J. Rotta. Translated from Mitt. Max-Planck-Inst. Strömungsforsch. (Göttingen) No. 1. (1950) 50p. (NACA-TM-1344)

2796

PROCESSES OF CONVECTION AND EVAPORATION. E. G. Richardson. Brit. J. Appl. Phys. 4, 65-9(1953) Mar.

The use of non-dimensional parameters to express the results of heat-transfer experiments and analogies with other problems in fluid mechanics are discussed. Applications of fundamental processes in convection are instanced in the thermal precipitator and hot-wire anemometer. As examples of processes involving convective evaporation the liquid drop and the wetted plate exposed to the wind and the application of such laboratory experiments in large-scale industrial plants and in meteorology are discussed. 23 references. (auth)

MATERIALS TESTING

2797

Standard Oil Co. of Ind.
DEVELOPMENT AND EVALUATION OF A GREASE FOR -65° TO +450°F. QUARTERLY REPORT [FOR] MAY 18 TO AUGUST 18, 1952. Cecil G. Brannen and Edward A. Swakon. Aug. 1952. 25p. (NP-4471; Quarterly Report No. 5)

Greases have been prepared with silicone oil thickened with 19 new aryl-substituted aromatic ureas. Based upon thickening power and bearing-performance tests, aryl-substituted di-ureas are superior to the mono-urea products. Either type may also be used in other synthetic oils, such as di-esters or fluorocarbons and in mineral oil. In the urea-silicone oil greases, the purity of the reactants appears to affect grease quality and optimum consistency seems to be in the range of 100 to 250 micropenetration. Greases were also prepared from 12 miscellaneous organic thickeners and 4 inorganic compounds. None is as satisfactory as the di-urea greases in all respects although one indigo grease performed about as well in the bearing test. A correlation was found between particle size and grease consistency in a series of Cu phthalocyanine greases. At present, the high temperature performance of the better greases is limited by the volatility and stability of the silicone oil. (auth)

WASTE DISPOSAL

2798

Massachusetts Inst. of Tech. Engineering Practice School, Oak Ridge

PERMANENT METHODS OF RADIOACTIVE WASTE DISPOSAL: AN ECONOMIC EVALUATION. A. C. Herrington, R. G. Shaver, and C. W. Sorenson. Issued Mar. 11, 1953. 50p. (K-1005)

Nine proposed methods for the permanent disposal of radioactive waste materials are discussed and the five most promising evaluated from a standpoint of cost. The preparation of concrete from waste process streams and subsequent disposal of this concrete by burial or dumping at sea is the cheapest and most efficient means of radioactive waste disposal. A bibliography is given. (auth)

2799

[Division of Reactor Development, AEC]

SANITARY ENGINEERING CONFERENCE HELD AT SOUTH DISTRICT FILTRATION PLANT, CITY OF CHICAGO.

Sept. 11, 1952. 203p. (WASH-129)

Twenty-five papers on various phases of sanitary engineering are included in this report. The results of radioactive waste-disposal operating and research activities at various AEC and contractor installations are presented and reviewed. (L.T.W.)

seem to be almost entirely Th-bearing at the surface and range from less than 1 in. to about 2 ft in thickness. They contain a maximum of about 0.1% equivalent U and an average of about 0.03% equivalent U. Investigations in the Hyder area and the Taku Harbor-Point Astley district failed to locate significant concentrations of U minerals. No uraniferous lodes were discovered in the Koyukuk-Chandalar region. The source of the uranothorianite in the placers at Gold Bench on the South Fork of the Koyukuk River was not found during reconnaissance, but a placer concentrate was obtained that contains 0.18% equivalent U. It is about ten times more radioactive than concentrates previously available from the area. Reconnaissance for possible lode concentrations of U minerals in the vicinity of reported fluorite occurrences in the Hope Creek and Miller House-Circle Hot Springs areas of the Circle quadrangle and in the Forty-mile district, east-central Alaska, found 0.055% equivalent U in a float fragment of ferruginous breccia in the Hope Creek area; analysis of samples obtained in the vicinity of the other fluorite occurrences showed a maximum of only 0.005% equivalent U. Examination of Ag-Pb and Mo occurrences and of a reported Ni prospect in the eastern Alaska Range revealed no radioactivity in excess of 0.004% equivalent U. Samples taken during radiometric reconnaissances at a zeunerite-bearing Cu lode in the Russian Mountains and two Mo lodes along the lower Yukon River in the lower Yukon-Kuskokwim region contain no more than 0.004% equivalent U. (auth)

2800

Geological Survey

AIRBORNE RADIOACTIVITY SURVEY OF THE DEVILS TOWER AREA, CROOK COUNTY, WYOMING. J. R. Hender-
son and R. M. Moxham. [Feb. 1953] 1p. (TEM-605)

A map shows the results of an airborne radioactivity survey covering forty-five sq. mi. of Devils Tower Area. The survey was made with scintillation-detection equipment mounted in a Douglas DC-3 aircraft. The anomalies shown on the map indicate localities of more-than-average radioactivity and suggest areas where U or Th deposits are more likely to occur. (J.E.D.)

2801

Geological Survey

GEOBOTANICAL RECONNAISSANCE NEAR GRANTS, NEW MEXICO. Helen L. Cannon. 1953. 10p. (GS-C-264)

The application of geobotanical methods of prospecting in U-bearing areas in McKinley County, near Grants, N. Mex., has been investigated briefly. The U deposits occur in the Todilto limestone member of the Wanakah formation and in the overlying Morrison formation, both of Jurassic age. Carbonaceous U ore in the Morrison formation contains a high percentage of Se, and Se-indicator plants are commonly associated with these deposits. Such plants have not been observed on the Todilto deposits. The average U content in the ash of trees rooted in ore deposits of the Todilto limestone member is more than 20 ppm, and trees rooted in barren limestone average about 10 ppm. The U content of the plant ash is detectable by fluorimetric methods. U analysis of trees growing on the Todilto bench and mapping of Se-indicator plants on the sandstones of the Morrison formation are recommended as a method of prospecting. (auth)

2802

SPECTROGRAPHIC ANALYSIS OF CARNOTITE ORES FOR THEIR U_3O_8 CONTENT. James M. Warfield. Quart. Colo. School Mines 47, 1-19(1952) Jan.

A determination by spectrochemical quantitative analysis of the amount of U in Colorado Plateau carnotite ores is presented. The method of analysis was standardized so it

MINERALOGY, METALLURGY,
AND CERAMICS

2800

Richards Mineral Engineering Lab., Mass. Inst. of Tech. THE ADAPTATION OF NEW RESEARCH TECHNIQUES TO MINERAL ENGINEERING PROBLEMS [PROGRESS REPORT]. Jan. 31, 1953. 39p. (NYO-3872; MITS-18)

A new method of preparing chloride-free $BaSO_4$ was developed. The adsorption of Na and chloride ions on quartz, xanthate on pyrite, and Cu on sphalerite and its desorption by NaCN and NaF is reported. Study was made of the reversibility of metal and metal-metal sulfide electrodes of Pb, Ag, and Zn, of the adsorption of flotation agents on AgI, and of electrodialysis as an effective tool in purifying colloidal solutions and suspensions. Zeta potential measurements in flotation systems, the behavior of complex metal anions with anion exchange resins, and the measurements of strain energy adsorption in a mild steel bar were carried out. An apparatus was constructed with which fractionation of ground products into size ranges of the order of a micron was attempted. (J.E.D.)

GEOLOGY AND MINERALOGY

2801

Geological Survey

PRELIMINARY SUMMARY OF RECONNAISSANCE FOR URANIUM AND THORIUM IN ALASKA, 1952. Helmut Wedow, Jr., et al. 1953. 17p. (GS-C-248)

Reconnaissance for U and Th in Alaska during 1952 was centered chiefly in parts of the lower Yukon-Kuskokwim region and northeastern, east-central, south-central, and southeastern Alaska. Reconnaissance in the northern part of Prince of Wales Island and parts of adjacent islands in southeastern Alaska found that the radioactive carbonate-hematite veins in the vicinity of Salmon Bay are probably limited in areal extent to the Prince of Wales Island coast from near Exchange Cove to Point Colpoys. The veins

could be used for rapid analysis of ores containing 0.01 to 1.0% U_3O_8 . The method may be used to determine the amount of U in ores which have been analyzed for total radioactive elements by G-M counter methods. By subtracting the per cent of U from the per cent of total radioactive material, the per cent of total radioactive material, the per cent of Th or other radioactive elements may be obtained. (J.E.D.)

2805

BIBLIOGRAPHY AND INDEX OF LITERATURE ON U-RANIUM AND THORIUM AND RADIOACTIVE OCCURRENCES IN THE UNITED STATES. PART I: ARIZONA, NEVADA, AND NEW MEXICO. Margaret Cooper. *Bull. Geol. Soc. Am.* 64, 197-234 (1953) Feb.

This bibliography consists of references to published literature, press releases, speeches, and both open-file and other unclassified reports dealing with U, Th, and other radioactive occurrences in Ariz., Nev., and N. Mex. It represents the first section of a comprehensive bibliography planned to cover references to all similar deposits throughout the world. (auth)

METALS AND METALLURGY

2806

Battelle Memorial Inst.

COLD DRAWING OF THORIUM WIRE. H. A. Saller, J. R. Keeler, R. J. Donley, and C. D. Graham. Oct. 10, 1951. Decl. with deletions Mar. 3, 1953. 12p. (AECD-3507; BMI-704)

Various lubricants for cold drawing Th wire were investigated. The tendency for Th to seize in the die was overcome and Th wire was successfully drawn using a thinned lacquer suspension of MoS_2 and fumed Pb and Zn oxides as a lubricant. Th wire as small as 0.005 in. in diameter could also be drawn by enclosing the Th in a Cu jacket. The lacquer-base lubricant also permitted the successful drawing of Zr and Ti wire. (auth)

2807

Battelle Memorial Inst.

OBSERVATIONS ON THE BEHAVIOR OF HYDROGEN IN ZIRCONIUM. C. M. Schwartz and M. W. Mallett. Feb. 3, 1953. Decl. Mar. 13, 1953. 26p. (AECD-3510; BMI-HWR-53)

Some embrittling effects noted in Zr have been explained by the presence of H. This phenomenon was initially correlated with the existence of a second phase in the microstructure. The amount of this phase is reduced by vacuum annealing and shows a direct correlation with the H content of the specimen. X-ray and electron-diffraction evidence identifies the phase as ZrH . Observations are given on the solubilities, diffusion rates, and equilibrium pressures of H in Zr, and the application of these data to the removal of H. (auth)

Atomic Energy Research Establishment, Harwell, Berks (England)

THE "ELASTIC HYSTERESIS" OF URANIUM. W. Munro and E. R. W. Jones. Nov. 18, 1952. 12p. (AERE-M/R-1054)

It is shown that the "elastic" properties of polycrystalline uranium at room temperature are very sensitive to the mechanical history of the sample. The metal exhibits "elastic hysteresis" losses by a factor 10 greater than those found in steel or brass. The energy dissipated per stress cycle has been measured for samples of various grain size and orientation, the results showing that the microstructure of the metal affects the degree of energy loss. It is concluded that the energy loss on stress cycling is due to mechanical twinning. (auth)

2808

Babcock and Wilcox Co.

EXPERIMENTAL INVESTIGATIONS OF CORROSION AND EROSION OF LIQUID METAL SYSTEMS: PROGRESS REPORT FOR JULY 15, 1952-AUGUST 15, 1952. A. W. Dana, Jr. and O. H. Baker. Aug. 15, 1952. 13p. (DC-52-28-140; [B and W]-5235)

The loop which had been used for testing the electro-magnetic pump circuit with Li was cleaned, and pump tests were made with Pb. The variations in heater outlet temp., heater inlet temp., and flow velocity are plotted as a function of testing time. The velocity in the loop was 3 fpm at the start of the test; this amounted to ~10,000 lbs/hr. After 80 hours a velocity trend to lower values was noted; after 113 hours a sharp decrease was observed; and after 117 hours complete plugging occurred. (L.M.T.)

2810

Mound Lab.

PREPARATION OF LANTHANUM METAL BY THE de BOER PROCESS: (FINAL REPORT). K. W. Foster, G. Pish, H. W. Schamp, J. M. Goode, and T. E. Eyles. Apr. 4, 1952. 29p. (MLM-686)

The application of the de Boer, or hot-wire reduction, process to the purification and isolation of La was investigated. This technique consisted of volatilizing anhydrous La iodide in vacuo onto a very hot surface. It was thought that with the proper conditions the salt would decompose, leaving La metal on the surface and releasing iodine. A literature survey of the process, as used for Hf, Zr, and other metals, indicated that in order to obtain a high decomposition coefficient for a compound the temperature of the decomposing surface should be such that the free energy of formation of the compound at that temperature is no greater than 40 or 50 kcal per mole. The free energy of formation of La iodide apparently does not reduce to this value below 2500°C. However, at 1500°C considerable loss of La metal is caused by its high vapor pressure. These facts would indicate considerable difficulty in isolating La by hot-wire reduction. A number of experiments are described in which attempts were made to circumvent these difficulties. It is shown that La of high purity could be obtained in small amounts by this method, but that it is doubtful if yields of better than 20 or 30% are possible. (auth)

2811

Lewis Flight Propulsion Lab., NACA

A LINEAR TIME-TEMPERATURE RELATION FOR EXTRAPOLATION OF CREEP AND STRESS-RUPTURE DATA. S. S. Manson and A. M. Haferd. Mar. 1953. 49p. (NACA-TN-2890)

A time-temperature parameter based on examination of the published stress-rupture data for a variety of materials is proposed in the form $(T - T_a) / (\log t - \log t_a)$, where T is temperature in degrees Fahrenheit, t is rupture time or the time to obtain a given total creep elongation, and T_a and $\log t_a$ are material constants which appear to be determinable from suitable rupture data in the time range between 30 and 300 hr. For the 40 materials investigated, use of this parameter in conjunction with experimental data involving rupture times below 300 hr resulted in very good extrapolations to longer rupture times (up to 10,000 hr where data were available) compared with corresponding predictions obtainable from a recently proposed parameter $(T + 460)(20 + \log t)$. For correlation of minimum creep-rate data, the parameter used is in the form $(T - T_a) / (\log r + \log r_a)$, where r is the creep rate and r_a is a material constant. (auth)

2812

Institute of Engineering Research, Univ. of Calif., Berkeley
EFFECT OF STRESS ON THE CREEP RATES OF POLY-

CRYSTALLINE ALUMINUM ALLOYS UNDER CONSTANT STRUCTURE. O. D. Sherby, R. Frenkel, J. Nadeau, and John E. Dorn. Feb. 15, 1953. 28p. (NP-4459; Technical Report 24)

A method is shown for the study of the creep-rate dependence of metals on the applied stress under the condition of constant structure. The method was applied to pure Al and to dilute solid solution alloys of Mg, Cu, Ge, Zn, and Ag in Al. The results revealed that the applied stress and the creep rate are related by the equation $\epsilon = 8e^{-\Delta H/RT} \sinh B_0$. B was found to be independent of the creep structure for a given material; a linear relation was found to exist between 1/B and the per cent of alloying addition to Al for a given solute element. Furthermore, 1/B is a function of the low-temperature solid-solution strengthening of the alloys. (auth)

2813

Dynamic Properties Lab., Calif. Inst. of Tech.

DYNAMIC STRESS-STRAIN RELATIONS FOR ANNEALED 2S ALUMINUM UNDER COMPRESSION IMPACT. J. E. Johnson, D. S. Wood, and D. S. Clark. Feb. 1953. 63p. (NP-4461; Technical Report 7)

This report presents the results of an experimental study of the stress-strain relation of annealed 2S Al when subjected to compression impact. Two methods of securing a dynamic stress-strain curve are considered, namely, the measurement of impact stress as a function of maximum plastic strain, and impact stress as a function of the impact velocity. The dynamic stress-strain curves obtained by these methods lie considerably above the static curve. The elevation in stress of the dynamic relations above the static relation increases progressively from zero at the elastic limit to about 20% at a strain of 4.5%. However, the two dynamic relations are not coincident, which indicates that the behavior of the material cannot be described by a single stress-strain curve for all impact velocities. A family of stress-strain curves which differ slightly from each other and which depend upon the final strain is postulated in order to correlate both sets of data adequately. (auth)

2814

Magnesium Labs., Dow Chemical Co.

LIQUIDUS DETERMINATIONS OF POLYNARY MAGNESIUM ALLOYS; FINAL STATUS REPORT [FOR] DECEMBER 1, 1949-APRIL 15, 1950. 27p. (NP-4477; Report 15004)

X-ray analyses of alloys in the systems $Mg_1Al_{12}-Mg_2Sn$ reveal the presence of the two compounds and no other phases. Thermal analysis of the system places the eutectic at 455°C with only a small amount of Sn. According to a metallographic analysis the eutectic composition is between 4 and 6% Mg₂Sn. No horizontal transformation lines were found above the eutectic temperature in this system. The alloy corresponding to the intersection of the lines connecting the systems Mg-Al₂Ca and Mg₁Al₁₂-Mg₂Ca contains only Mg and Al₂Ca according to x-ray analysis. Thermal analysis of the Mg-Al₂Ca system was not completely satisfactory, but it placed the eutectic temperature at 535°C. Metallographic examination reveals the eutectic to be between 70 and 80% Mg. Thermal analysis of the system Mg₂Bi₂-Mg₂Pb suggests a binary system with a peritectic reaction. X-ray reports of this system give as high as 4 phases for some alloys. This may be due to the absence of equilibrium. An attempt to establish quasi-binaries in the systems Mg-Ca-Pb and Mg-Ca-Bi were unsuccessful due to difficulty in preparing the alloys. X-ray analysis could not identify the greater portion of the alloys. (auth)

2815

Massachusetts Inst. of Tech.

FUNDAMENTALS OF COLD WORKING AND RECRYSTAL-

LIZATION: TECHNICAL PROGRESS REPORT NO. 10, SCOPE 3. B. L. Averbach, M. Cohen, S. Allen, P. Fopiano, and F. Herbstein. Mar. 31, 1953. 4p. (NYO-3816; Technical Progress Report No. 10)

Progress is briefly reported on deformation of α -brass single crystals, deformation of Al single crystals, and radiation damage to Li-Mg alloys. (See NYO-3812 for preceding report.) (L.T.W.)

2816

Massachusetts Inst. of Tech.

SOLID SOLUTIONS AND GRAIN BOUNDARIES: TECHNICAL PROGRESS REPORT NO. 15, SCOPE 2. B. L. Averbach, M. Cohen, W. F. Flanagan, J. Hilliard, P. S. Rudman, and E. E. Underwood. Mar. 31, 1953. 3p. (NYO-3817; Technical Progress Report No. 15)

Progress is briefly reported on thermodynamics of solid Al-Ag and Al-Cu alloys, Hall measurements, and precipitation kinetics in the Au-Ni system. (See NYO-3811 for preceding report.) (L.T.W.)

2817

[Columbia Univ. School of Mines]

THE STUDY OF DIFFUSIONLESS PHASE CHANGES IN SOLID METALS AND ALLOYS: [PROGRESS REPORT FOR DECEMBER 1, 1952 TO FEBRUARY 28, 1953]. T. A. Read, M. W. Burkhardt, C. W. Chen, M. Wechsler, and D. S. Lieberman. 5p. (NYO-3961)

Habit-plane indices and shear were calculated for AuCd, yielding results in good agreement with experimental observations. The theoretical treatment consists essentially of setting up an average distortion matrix which describes the displacements which occur upon transformation. All necessary rotation matrices and transformation matrices can be obtained by matrix algebra. X-ray and metallographic studies are reported on transformations in the AuCd alloy containing 49 to 50 at.% Cd. Equilibrium resistivity measurements were made on two AuCd (47.5 at.% Cd) crystals in the temperature range 20 to 340°C. (For preceding quarter see NYO-3960.)

(L.T.W.)

2818

General Electric Research Lab.

DEVELOPMENT OF ZIRCONIUM BASE ALLOYS; THIRTEENTH QUARTERLY REPORT (PROGRESS REPORT NO. 14). J. H. Keeler. Jan. 5, 1953. 6p. (SO-2508; RL-840; Quarterly Report No. 13; Progress Report No. 14)

Studies of the tensile behavior of binary alloys of Zr are reported to be in progress. No experimental data are included. (C.H.)

2819

Technical Information Service, AEC

ZIRCONIUM: A BIBLIOGRAPHY OF UNCLASSIFIED REPORT LITERATURE. Hugh E. Voress and Robert E. Allen, comps. Mar. 27, 1953. (TID-3010(suppl.1))

This bibliography includes reports which were available at the Technical Information Service up to March 15, 1953. The bibliography is a supplement to TID-3010 and contains 95 references to unclassified report literature on Zr. Author, subject, and report number indexes are included. (auth)

2820

Technical Information Service, AEC

TITANIUM METALLURGY: A BIBLIOGRAPHY OF UNCLASSIFIED REPORT LITERATURE. Hugh E. Voress, Comp. Apr. 14, 1953. (TID-3039)

This bibliography contains 364 references to Ti metallurgy. A few references on uses in ceramics are also included. The references were obtained from Document Services Center, Armed Services Technical Information Agency, Technical Information Division, Library of Congress.

and the Technical Information Service. Author, subject, and numerical indexes are included. (auth)

2821

THE EFFECT OF DEFORMATION OF THE SURFACE LAYER OF A METAL DURING OXIDATION. P. D. Dankov and P. V. Churaev. Translated by Esther Rabkin from *Doklady Akad. Nauk. S.S.R.* 73, 1221-34 (1950). 13p. (AEC-TR-603; TT-245)

A mica or celluloid plate was rigidly fastened in a vacuum apparatus. The plate was ~ 2 cm long, ~ 0.6 cm wide, and $\sim 15 \mu$ thick. One side of the plate was covered with a thin metallic layer. After O_2 was introduced into the apparatus, the plate curved noticeably, indicating a deformation of the metallic layer during oxidation. Oxidation curves (observation time as abscissa and deviation of the free end of the mica plate from its initial position as ordinate) showed that the deformation had different directions for Fe (and Ni) and for Mg. During the initial moments of the oxidation of the metal, the deformation increased rapidly and after 30 to 40 min it either approached a constant value or it continued to increase slowly. Approximate conclusions are presented regarding the value of the tensions and of the relative deformation in the oxide layer for the limiting cases of oxidation of Fe, Ni, and Mg. (L.T.W.)

2812

STUDY OF THE MECHANISM OF THE OXIDATION OF BINARY ALLOYS OF IRON-CHROMIUM AT ELEVATED TEMPERATURES. Jean Moreau. Translated by Mary E. Lee from *Compt. rend.* 236, 85-7 (1953). 3p. (AEC-TR-2013; CF-53-3-48)

The oxidation in air of Fe-Cr alloys containing 2.6, 7.5, 18.0, 23.0, and 30% Cr was studied by subjecting them to 800 and 1250° temperatures and examining the oxides by means of x-ray diffraction and micrography. From these studies a composition diagram has been made and, from previous studies of the solid-state reactions between Fe oxides and Cr_2O_3 , the mechanism of the oxidation of the alloys is suggested. (L.M.T.)

2823

VANADIUM-OXYGEN SOLID SOLUTIONS. A. U. Seybolt and H. T. Sumson. *J. Metals (N.Y.)* 5, 292-9 (1953) Feb.

The results of an investigation of vanadium-rich V-O solid solutions are presented, indicating the structure and lattice parameters of two solutions, α and β , and their approximate temperature-composition existence. The α solution is the terminal b.c.c. one, and contains up to 3.2 at.% O. The β solution has an ordered b.c.t. structure, is formed at 1270°C, and exists from about 15 to 22 at.% O. From the evidence available, the various phase boundaries have no appreciable temperature dependence. Evidence has been found for a polymorphic transformation in pure V at 1550°C. (auth)

PHYSICS

2824

Ames Lab.

CALORIMETRIC APPARATUS IN THE AMES LABORATORY. Maurice Griffel and Richard Skochdopole. [nd] 19p. (ISC-312)

This report describes the physical characteristics of an adiabatic calorimeter and the associated electrical circuits for the measurement of heat capacities of solid materials in the temp. range of 15 to 300°K. One feature of the installation is its flexibility. All emf's to be measured are routed

through a central switchboard so that the potentiometers may be used in conjunction with other experiments. The experimental procedure in calorimetry involves cooling a weighed sample by placing it in thermal contact with various refrigerants such as liquid N and liquid H. Helium is used as the thermal exchange gas. After the sample attains its low temp. the H is pumped off so that the sample is adiabatically isolated and is surrounded by heat shields. The innermost shield may be electrically heated so as to have at any time the same temp. as the sample. Measured amounts of electrical energy are introduced into the sample for definite time intervals, and the temp. increase for each energy input is accurately measured by a Pt resistance thermometer. In this way the heat capacity is measured over the entire range. (auth)

2825

Columbia Univ.

A METHOD FOR THE MEASUREMENT OF THE SPECIFIC HEAT OF SODIUM VAPOR: [PROGRESS REPORT]. M. M. Makansi and W. A. Selke. Apr. 1, 1953. 21p. (NYO-3100)

A method for the measurement of the specific heat of Na vapor at one atmosphere in the range of 200°C superheat, is presented. This method can be extended to include a wider range of temperatures and pressures; it also can be used for the determination of the specific heats of various other fluids of very high boiling point. The method is suitable at temperatures where the heat loss to the surroundings is appreciable compared to the sensible heat which can be transferred to a fluid stream in test equipment. (auth)

2826

Radiation Lab., Univ. of Calif., Berkeley

SURFACE GRADIENT VS. ELECTRODE CONTOUR IN A RESONANT CAVITY. A. D. Schelberg. Dec. 4, 1952. 23p. (UCRL-2036)

The BB perturbation technique has been used to measure the electric field distribution both on the surface of variously shaped electrodes and in the gap in a reentrant resonant cavity. A brief resumé of the BB method, including its limitations, is given. Curves are presented showing the field distributions. A dimensionless quantity, the ratio of the maximum field on the surface to the average field in the gap, is given for each electrode. (auth)

2827

Radiation Lab., Univ. of Calif., Berkeley

EMPIRICAL CONSIDERATIONS OF ENTROPY. 1. THE ENTROPIES OF THE OXY-ANIONS AND RELATED SPECIES. James W. Cobble. Feb. 3, 1953. 14p. (UCRL-2103)

The partial molal entropies for oxy-anions and related species have been correlated as a function of the charge, interatomic distance, and certain structural factors. An equation is given by which the entropy for unknown species can now be estimated fairly accurately. In the few cases where the method does not give good agreement, the data are open to suspicion as indicated by other independent observations. Some applications and extensions of the method are indicated for future study. (auth)

2828

Radiation Lab., Univ. of Calif., Berkeley

HEATS OF FORMATION AND ENTROPIES OF HS^- AND S^{2-} ; POTENTIAL OF SULFIDE-SULFUR COUPLE. J. W. Kury, A. J. Zielen, and W. L. Latimer. Feb. 12, 1953. 11p. (UCRL-2108)

The heat of neutralization of H_2S solutions by NaOH was measured at 25° for various mole ratios of NaOH to H_2S . These data, with the two dissociation constants of H_2S , allow calculations of the free energies and heats of formation and the partial molal entropies of S^{2-} and HS^- . The results are for S^{2-} and HS^- respectively: $\Delta F^\circ = 20.6$ and

3.00 kcal, $\Delta H^0 = 7.8$ and -4.10 kcal, and $S^0 = -4$ and 15.0 eu. The potentials of the $S^- - S$ couple is 0.447 v. (auth)

2829

VAPOR PRESSURE OF LITHIUM BETWEEN 462° AND 642°. Marguerite Maucherat. Translated from *Compt. rend.* 208, 499-501(1939). 3p. (AEC-TR-2012)

Seventeen Li vapor-pressure measurements determined by an atomic beam method are listed, ranging from 1.1 baryes at 462°C to 208.5 at 642°C. The vapor pressure can be represented by the formula $\log_{10} P_{mm} = 8.012 - 8172/T$, where T is the absolute temperature. The boiling temperature is 1530°K, and the heat of vaporization is 36,600 cal/g-atom. (L.T.W.)

2830

THE EFFECTS OF OXYGEN ON THE ELECTRICAL PROPERTIES OF OXIDE CATHODES. A. A. Shepherd. *Brit. J. Appl. Phys.* 4, 70-5(1953) Mar.

The mechanism of reduction of electron emission from oxide-coated cathodes by O and the recovery process after O poisoning have been studied using mass-spectrometer techniques, showing that the formation of singly charged O ions in the cathode coating plays a major part in the recovery process. Further studies employing diodes having a helical probe embedded in the cathode coating provided information on the reduction of coating conductivity by O, the results being explicable on the basis of the Loosjes and Vink theory of conduction, which postulates two conduction processes in the cathode, one predominating below, the other above 700°K. The results obtained in both series of experiments are discussed, and a mechanism is proposed to account for the observed phenomena on the poisoning of emission and conductivity of cathode coatings by O. (auth)

2831

THE MACROSCOPIC THEORY OF SUPERFLUID $He^3 - He^4$ MIXTURES. P. J. Price. *Phys. Rev.* 89, 1209-15(1953) Mar. 15.

The macroscopic hydrodynamic equations to the reversible linear approximation for mixtures are set up and analyzed, without making any assumptions beyond that of the traditional form of the two-fluid model. The equations of wave motion are derived and discussed. A novel feature of them is appreciable coupling between pressure and entropy-density fluctuations. It is shown how the constants appearing in the equations may be expressed partly in terms of the measured partial vapor pressures. Pomeranchuk's formula for the velocity of second sound appears as a possible special case; and it is shown how his assumption that the He^3 component is carried entirely with the normal velocity may be tested experimentally. The intervention of isotopic diffusion is briefly discussed. 33 references. (auth)

2832

CHARGE STATES OF A HELIUM BEAM IN HYDROGEN, HELIUM, AIR, AND ARGON. Elias Smitzer. *Phys. Rev.* 89, 1237-44(1953) Mar. 15.

Measurements have been made of the fractions of a He beam in the He^0 , He^+ , and He^{++} charge states in the energy range of 100 to 480 kev for beams in H, He air, and A. For the four gases, the He^0 and He^+ components are equal for helium energies of 148, 145, 98, and 115 kev, respectively. The ratios of the electron-loss to electron-capture cross sections between He^+ and He^{++} fitted a simple power dependence of $(\sigma_1/\sigma_c) \propto V^m$, where V is the velocity of the helium in the beam and m equals 6.1, 5.1, 5.2, and 6.3, respectively, for the four gases studied. For electron capture and electron loss between He^0 and He^+ the exponent m varies from 2.6, 2.0, 2.8, and 3.4 at 100 kev to 4.0, 4.0, 4.3, and 5.1 at 450 kev. 17 references. (auth)

COSMIC RADIATION

2833

PRODUCTION OF MESONS IN VARIOUS CONDENSED MATERIALS. A. Bonetti, N. Dallaporta, M. Merlin, and G. Dascola. *Nuovo cimento* (9) 10, 215-29(1953) Mar. 1. (In Italian)

Ilford G5 plates, 400 μ thick, have been exposed at 2000 m between S, Sn, and Pb blocks; other plates have also been exposed in air for comparison. All the π - μ events and σ stars have been observed, in order to investigate the production of π mesons in different materials. From the experimental results, the following ratios for the production cross sections have been obtained: $\sigma_S : \sigma_{Sn} : \sigma_{Pb} = 1 : 0.9 \pm 0.3 : 0.5 \pm 0.25$. This behavior of the production cross section as a function of the mass number is different from the one observed in cyclotron experiments, and is likely to indicate that in the present case the production follows a different mechanism, owing to the greater energies which are involved. In order to explain the decrease of the cross section with increasing mass number, the values presently known of the partial cross sections for meson absorption and scattering are discussed, and a model is proposed which considers the plural scattering of mesons in nuclear matter as a prominent phenomenon. Following this model, the energy losses and absorption probabilities of the mesons in the interior of the nuclei increase rather quickly with the increase of the nuclear radius, and compensate the increase of the production of mesons with the increase of the number of nucleons, in the primary nucleon-nucleon collision. (auth)

2834

CONTRIBUTION TO THE ATMOSPHERIC COSMIC-RAY ELECTRONIC COMPONENT OF THE DECAY OF THE μ PARTICLE. R. Stroffolini. *Nuovo cimento* (9) 10, 300-7 (1953) Mar. 1. (In Italian)

Starting from the experimental spectra of the μ particles in the atmosphere, the contribution to the electronic component from the decay of the μ particles has been calculated. The Bhabha and Chakrabarty solution of the diffusion equations has been used, taking into account only the first two terms of the series of the solution given by these authors. The vertical intensity of the electrons with energy greater than 10⁷ ev, originating from the μ -particle decay is found to be markedly less than generally calculated by other authors (at sea level $I_V = 1.0 \times 10^{-3} \text{ cm}^{-2} \text{ sec}^{-1} \text{ sterad}^{-1}$); this can be probably justified by the fact that in all the preceding calculations the μ particle was assumed to decay into two instead of three particles. (auth)

2835

EFFECTS OF THE ATMOSPHERE ON THE PENETRATING COSMIC RADIATION. Robert L. Chasson. *Phys. Rev.* 89, 1255-6(1953) Mar. 15.

A comparison is made of the results of three independent studies of upper-atmospheric influences on the penetrating cosmic radiation. The results of Cotton and Curtis are in disagreement with those of Duperier and the author, who agree very closely on the value of the upper-atmospheric temperature coefficient for the hard radiation observed at sea level. The work of Cotton and Curtis is examined with regard to method of data reduction, whereupon it is suggested that they are possibly in error because of statistical inadequacy of the cosmic-ray data and an improper mode of application of meteorological data. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

2836

Institute for Atomic Research, Iowa State Coll. THE DEUTERIUM EFFECT ON HYDROGEN BOND DISTANCES IN CRYSTALS. R. E. Rundle. Institute for Atomic

Research, Iowa State Coll. and Ames Lab. [Feb. 15, 1953.]
2p. (ISC-315)

Some years ago Robertson and Ubbelohde found that strong O-H...O hydrogen bonds are lengthened when D is substituted for H (Robertson and Ubbelohde, *Proc. Roy. Soc. (London)* A170, 222(1939); Ubbelohde, *ibid.* A173, 417(1939)). Though well substantiated (Ubbelohde and Woodward, *ibid.* A179, 399(1942); Dickinson and Ubbelohde, *Acta Cryst.* 3, 6(1950)), this result is contrary to expectation, and to results found for most other substances (Zintl and Harder, *Z. physik. Chem.* B28, 478(1935); Rundle, *J. Am. Chem. Soc.* 69, 1719(1947)). Nordman and Lipscomb have recently suggested that the abnormal effect can be understood in terms of the broad, nearly square-well potential energy field for H in a strong H bond (Nordman and Lipscomb, *J. Chem. Phys.* 19, 1422(1951)). At a given (sufficiently high) temperature the higher vibrational levels of the D compound will be filled to a larger extent than the more widely spaced levels in the H compound, leading to a broadening of the D distribution, and thence to a broadening of the well. The one point which offers hope for testing the Nordman-Lipscomb explanation of the Robertson-Ubbelohde effect is that it makes the effect temperature dependent. Thus, at sufficiently low temperatures essentially only the zero vibrational states will be occupied in both H and D compounds, and then the substitution of D for H should shorten, or at least not lengthen, strong H bonds. To test the proposal it is necessary to have accurate lattice constants for strongly intermolecularly H-bonded crystals, deuterated and undeuterated, both at normal and low temperature. The only data in the literature which come close to fulfilling these requirements are those for ice and heavy ice. Megaw (*Nature* 134, 900(1934)) reports lattice constants at 0 and -66°C as follows:

	0°	-66°
H ₂ O	$a_0 = 4.5135$	$c_0 = 7.3521$ Å
D ₂ O	4.5165	7.3537
	$a_0 = 4.5085$	$c_0 = 7.338$ Å
	4.5055	7.338

Thus, the data support the Nordman-Lipscomb explanation, since there is a reversal of effect in this temperature range. The size of the effect is, however, about comparable with the experimental error in the lattice constants. It would be interesting to see the results for shorter H bonds where the changes should be more spectacular. (Entire report)

ELECTRICAL DISCHARGE

2837

Institute for the Study of Rate Processes, Univ. of Utah
INDUCTION OF CHEMICAL REACTIONS IN A HIGH FREQUENCY DISCHARGE. 6. CARBON DIOXIDE-WATER VAPOR MIXTURES. Kenneth A. Wilde, Bruno J. Zwolinski, and Ransom B. Parlin. Mar. 1, 1953. 9p. (AECU-2458; Technical Report No. 6)

A study was initiated to isolate one and possibly two C-atom compounds formed by the reduction of CO₂ by water vapor in a h-f arc. Under the conditions employed, no interesting reduction products of the CO₂-H₂O reaction were formed in quantities greater than ~10 ppm. Decomposition of CO₂ to CO takes place to the extent of ~5%. (L.T.W.)

GASES

2838

SEPARATION OF GASES BY SORPTION PROCESSES. H. Wirth. *Monatsh.* 84, 156-68(1953) Feb. 15. (In German)

After presenting the most important principles, the author describes measurements of the separative effect of a desorption method on active carbon which was satisfactory for analytic separation of the binary mixtures N₂-CO, N₂-CH₄, CH₄-CO, and C₂H₄-CO₂. An analytic separation

was not possible for the mixtures N₂-O₂, O₂-A, and N₂-A; the reason for this was studied in detail for the last-named system. (tr-auth)

2839

A SIMPLE METHOD FOR SIMULTANEOUS DETERMINATION OF THE SPECIFIC HEAT, INTERNAL FRICTION, AND THERMAL CONDUCTIVITY OF GASES. Hermann Senglben. *Z. angew. Phys.* 5, 33-9(1953) Jan. (In German)

Thermal constants of gases can be determined by measurements easily carried out on a hot wire in different gases. Details of the method are given, and data thus obtained on N₂, O₂, CO₂, and various organic gases are tabulated. (G.Y.)

INSTRUMENTS

2840

Research Foundation, Okla. Agricultural and Mechanical Coll.

PART A. A STUDY OF THE CHARACTERISTICS AND

APPLICATIONS OF A NEW POLAROGRAPHIC ELECTRODE.

PART B. A STUDY OF ANODIC REACTIONS IN POLAROGRAPHY; FINAL REPORT. Paul Arthur. Feb. 19, 1953. 111p. (AECU-2455)

A new polarographic electrode consisting of an untreated glass tube containing Hg surrounded by a rotating stirring tube is described. Wetting of the electrode by the solution, producing irregularities in the polarograms, was overcome by treating the inner surface of the electrode tube with various substances. The best coating was ceresin wax and the second best was Pt. A paraffin wax surface also yielded favorable results. Other coatings are evaluated. Stabilization of the electrode wetting by use of a liquid detergent improved the results. Deliberate wetting of the electrode with solution prior to electrolysis gave good results. The influence of variables on the behavior of the electrode was studied. A study of anodic reactions in polarography is included. (L.T.W.)

2841

National Bureau of Standards

A DIAPHRAGM-TYPE, CAPACITANCE-TYPE, MICROMANOMETER FOR VERY LOW DIFFERENTIAL PRESSURES. Thomas A. Perls, William H. Kaechele, and Daniel S. Goalwin. Jan. 1953. 16p. (NBS-2165)

A series of calibration tests shows that a thin diaphragm may be combined with a capacitance-type pickup and resonant-bridge carrier system to provide a method of measuring differential pressures which may be as low as 0.001 to 1 μ Hg. (auth)

2842

Illinois Univ.

ORDVAC MANUAL [FOR] 1952. Oct. 31, 1951. 414p. (NP-4455)

ORDVAC, a general-purpose digital computer, was built by the Univ. of Illinois under a contract from the Ballistic Research Labs. of Aberdeen Proving Ground. A general description of the machine is given and then each component described separately. The control, maintenance, operating procedure, and trouble-shooting techniques are outlined. The machine is now at the Ballistics Research Labs. (L.M.T.)

2843

Radiation Lab., Univ. of Calif., Berkeley

EXTENDING THE RANGE OF A SELF-BALANCING RECORDING POTENTIOMETER WITHOUT REDUCING RESOLUTION. H. B. Keller and C. G. Dols. Dec. 12, 1952. 15p. (UCRL-2049)

The combination of the UCRL "Lobetrol" (an assembly of relays, switches, etc.) with a commercial recorder

(such as Leeds and Northrup Type G Speed-O-Max) constitutes a self-balancing, indicating, and recording potentiometer whose range is a multiple of the range of the commercial recorder. The resolution of the combination is equal to the resolution of the recorder. (auth)

2844

THE USE OF LARGE SCALE COMPUTING IN PHYSICS. John Sheldon and L. H. Thomas. *J. Applied Phys.* **24**, 235-42 (1953) Mar.

A number of methods of numerical solution of systems of partial differential equations are surveyed. The size and speed of computing machines required to solve problems of varying complexity are discussed. Finally, a number of typical problems which have been solved numerically by various authors are described. 16 references. (auth)

2845

A CONTROLLED GAS LEAK. James Morrison. *Rev. Sci. Instruments* **24**, 230-1 (1953) Mar.

A leak system is described whereby a steady pressure in the range from 5×10^{-7} to 5×10^{-3} mm Hg can be maintained in a vacuum system which is being exhausted continuously at a rate of ~2 to 3 liters/sec. The leak system employs porous porcelain rods similar in material to those described by Hagstrum and Weinhart (*Rev. Sci. Instruments* **21**, 394 (1950)). The rate of flow of gas through the rod is determined by the pressure of gas. Area is controlled by the displacement of surrounding Hg, using a magnetically operated plunger. (auth)

ISOTOPES

2846

National Bureau of Standards

A BIBLIOGRAPHY OF RESEARCH ON THE PROPERTIES OF THE ISOTOPES OF MOLECULAR HYDROGEN.

Abraham S. Friedman and Charles W. Beckett. Mar. 15, 1953. 103p. (NBS-2266)

A bibliography of published research and unclassified government reports on the H^2 and H^3 isotopes of molecular H has been compiled for the period 1932 to 1952. The bibliography follows the form of the Kimball bibliography (National Nuclear Energy Series Div. III, Vol. 4C) and the National Bureau of Standards annual bibliography on the properties of H^2 compounds. (auth)

ISOTOPE SEPARATION

2847

Rensselaer Polytechnic Inst.

THE DIFFUSION-DISTILLATION PROCESS FOR THE SEPARATION OF ISOTOPES; ANNUAL REPORT. C. W. Williamson. Mar. 1, 1953. 33p. (SO-3252)

The feasibility of separating isotopes by diffusion through an inert-gas barrier is discussed. The theoretical discussion includes methods for calculating mutual diffusion coefficients for binary systems, an approximate method for estimating diffusion coefficients in a ternary gas system including the assumptions present in such a calculation, and a method for estimating the efficiency of a barrier gas in separating isotopes when the molecular weight of the diffusing vapor is known. The factors which must be considered in the design of an experimental system for the separation of isotopes by diffusion through an inert-gas barrier are discussed, and the design of the system which is being used for this work is included. A discussion of a possible method of determining the effect of several of the experimental variables on the operation of the system without requiring mass-spectrometric analyses is included. The results which have been obtained to date are included along with the total separation factor, separation factor per stage, and average stage efficiency. A comparison of four methods

of gaseous diffusion for isotope separation is given in which the advantages and disadvantages of each of the methods are discussed. (auth)

MASS SPECTROGRAPHY

2848

ANALYSIS OF THE LINEAR RF MASS SPECTROMETER. P. A. Redhead and C. R. Crowell. *J. Applied Phys.* **24**, 331-7 (1953) Mar. (cf. NSA 6-2703)

The linear r-f mass spectrometer previously described is analyzed for small signal operation. The results are obtained in a closed form for any entrance phase where previously only a graphical solution for an optimized entrance phase was obtained. Expressions for resolving power and current efficiency are derived for both sine-wave and square-wave operation. It is shown that although high resolving power may be more readily obtained with square-wave operation, the product of resolving power and efficiency is approximately the same for sine or square waves. Loss of resolving power caused by the thermal energies of the ions is shown to be less troublesome with square-wave operation. (auth)

2849

DIRECT COMPARISON OF m/e FOR THE POSITRON AND THE ELECTRON. L. A. Page, P. Stehle, and S. B. Gunst. *Phys. Rev.* **89**, 1273-7 (1953) Mar. 15.

A relativistic, double-focusing mass spectrometer has been built to operate with 55-kev electrons. It has reversible electric field and fixed magnetic field. Positrons from Na^{22} and electrons from a hot filament alternately follow identical trajectories in opposing directions. The magnitude of the electric field required to focus is used as the measure of m/e . Seventeen positron runs were made intermediate in time between twelve electron runs. The rms deviation of the data lies within the standard deviation associated with positron counting. The result is

$$[(m/e)^- - (m/e)^+]/(m/e) = 26 \pm 71 \times 10^{-6}$$

where the uncertainty is the standard deviation. (auth)

MATHEMATICS

2850

Kenyon Coll.

A MATHEMATICAL APPARATUS FOR QUANTUM-MECHANICS. PART 2. DIAGONAL REPRESENTATION OF MAXIMAL NORMAL OPERATORS. Otto Martin Nikodým. [1952]. 65p. (AECU-2454)

This part, the second of four, gives the maximal normal operator N in the separable and complete Hilbert-Hermite space \mathcal{K} the diagonal form $\tilde{\mathcal{K}}(f(\tau)) = g(\tau) \cdot f(\tau)$, where $f(\tau)$ is a variable function and $g(\tau)$ a fixed function of the variable trace τ , and where $g(\tau)$ depends on N . For Part 1 see AECU-2386; NSA 7-1730. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

2851

Argonne National Lab.

ANALYSIS OF FLUORESCENT X-RADIATION BY MEANS OF PROPORTIONAL COUNTERS. Robert E. Rowland. Feb. 1953. 5p. (AECU-2448; UAC-719)

A method is described for rapidly analyzing the x-ray spectrum originating from external targets when exposed to the beams from x-ray tubes. The beam to be analyzed is intercepted through a 0.005-in. Be window by a proportional counter (4×12 in.) filled at 1.0 atm. with 90% A and 10% CH_4 . The output from the detector is recorded by means of a motor-driven single-channel analyzer and the results are registered directly on a Brown potentiometer. X rays

between 2.5 and 15.0 kev can be detected and the counter is particularly valuable in evaluating spurious x rays. Both the primary and fluorescent beam should be well collimated and the collimating materials should be of the same Z as the target or of $Z \leq 15$. The spectrum obtained with a Ti radiator and lucite collimators is shown. (L.M.T.)

2852

Army Medical Research Lab., Fort Knox

SCINTILLATION COUNTERS. A. T. Krebs. Aug. 11, 1952. 67p. (AMRL-89)

This report is essentially a critical review of work done on scintillation counters, emphasizing radiobiological applications. 173 references. (auth)

2853

Argonne National Lab.

APPLICATION OF THE SCINTILLATION SPECTROMETER TO FISSION PRODUCT ANALYSIS. C. E. Crouthamel and C. E. Johnson. Nov. 1952. 23p. (ANL-4924)

The application of a stable, high-resolution, NaI, Tl-activated scintillation probe, designed by the Instrument Research Division of ANL, in conjunction with single-channel analyzer circuits to the estimation of fission products was studied. The spectrometer calibration curve was obtained using the scale readings as one variable and the literature energies for Cs^{137} , Cu^{64} , Ru^{103} , Rh^{103} , Nb^{95} , Zr^{95} , and Co^{60} as the other. From the calibration it was determined that the instrument can measure γ energies to an accuracy of 0.003 Mev. Gamma scintillation spectrograms are given for Cs^{137} , Zr^{95} - Nb^{95} , Ru^{103} - Rh^{103} , Ru^{106} - Rh^{106} (in secular equilibrium), and a rare-earth mixture of Ce^{141} and Ce^{144} - Pr^{144} . The advantage of using a Be absorber for the β radiation when dealing with weak γ 's is shown. Scans of three hard β groups in the typical fission-product mixture show no γ radiation. A summary fission-product spectrogram and a gross fission-product scan for irradiated U are presented. (L.M.T.)

2854

Hanford Works

EVALUATION OF ALPHA COUNTING INSTRUMENTS. D. G. Miller and M. B. Leboeuf. Feb. 16, 1953. 37p. (HW-26852)

The fundamentals of proportional-counter theory are reviewed and the effect of collecting electrode diam., source position, and the addition of a cathode-follower circuit on the characteristics of proportional α counters are investigated. The operating characteristics of seven different α counting instruments are evaluated through a determination of the distribution of α and β pulse amplitudes displayed by these instruments. The evaluation of these instruments is made toward the selection of the most favorable α -counting system for analytical methods requiring a precision of $\pm 0.1\%$ at the 99% confidence level. The most satisfactory α -counting system for routine use, among the instruments evaluated here, utilizes a chamber designed by C. J. Borkowski in conjunction with a cathode-follower circuit and a Simpson amplifier. A grid ionization chamber is investigated and the extreme counting stability and high β tolerance of this instrument suggest its use as a source-calibration or reference instrument. (auth)

2855

Livermore Research Lab., Calif. Research and Development Co.

ELECTRIC FIELD MEASUREMENTS IN CAVITY RESONATORS BY THE "GLO-BALL" METHOD. O. A. Fredriksson, W. W. Klein, and J. D. Salisbury. Jan. 26, 1953. 8p. (MTA-23)

A simple and direct method of measurement of the electric field distribution along the z axis of large cavities has been devised. This method consists of introducing a thin-

walled glass ball containing gas at a low pressure into the cavity at the point where the gradient is to be measured and raising the input power until the gas within the ball ionizes. The voltage induced in a monitor loop is read the instant before the ball glows, giving the maximum meter reading, since the induced voltage drops somewhat when ionization takes place. The gradient at the measured point, corresponding to any arbitrary loop voltage, can be calculated easily if the gradient required for ionization is known and the ionization point of the ball is stable. Measurements can be made at a number of points, and a profile of gradient can then be plotted. The integration of the plot will yield end-to-end voltage for a given loop voltage. Such measurements have been made on a large-scale cavity. Results obtained differ from previous work based both on B-B measurements on a small model and on beam dynamics by less than 4%. This deviation is less than the accuracy claimed for the particular B-B measurement and, furthermore, is within the percentage error claimed for the r-f voltmeter used in the "glo-ball" work. (auth)

2856

Argonne National Lab.

PARAMAGNETIC RESONANCE DETECTION USING DOUBLE FIELD MODULATION. Bernard Smaller and E. L. Yasaitis. Feb. 2, 1953. 4p. (UAC-713)

Double magnetic-field modulation is employed to amplify the resonance signal at an intermediate frequency. The magnetic field modulation is equivalent to an indirect frequency modulation of the oscillator; thus a field modulation at f_L cps will be converted by the resonance phenomenon into a signal whose r-f spectra contain the terms $f_H + mf_L$ ($m = -\infty, \dots, +\infty$) of amplitude directly related to the signal strength by the corresponding Bessel functions. Upon detection, the mf_L terms form the complete resonance signal, while for recording by a lock-in narrow-band amplifier having a band pass characteristic of $f_L \pm \Delta f/f_L > 1$, the field modulation amplitude is reduced so that only the $m = \pm 1$ terms are of importance. The method may be easily extended to provide for an intermediate frequency signal by superimposing an additional field modulation of frequency f_L . The r-f signal can then be represented by the composite spectra

$$V = \sum_{n=-\infty}^{+\infty} \sum_{m=-\infty}^{+\infty} a_{nm} \sin 2\pi[f_H + nf_L + mf_L].$$

Upon mixing with the f_H carrier the resultant signal, contained in the terms $nf_L + mf_L$, may be amplified in a narrow-band amplifier centered about f_L . (auth)

2857

NEW APPARATUS FOR THE MICROCHEMICAL DETERMINATION OF MOLECULAR WEIGHTS BY EFFUSION.

W. Mund, J. A. Herman, and P. Huyskens. Translated by R. C. Bacon from Bull. Classe Sci., Acad. Roy. Belg. (5) 38, 106-12 (1952). 8p. (AEC-TR-2008)

The gas contained in a constant volume, at room temperature, was evacuated by means of a pump with sufficient capacity through an orifice whose diameter does not exceed a few hundredths of a centimeter. The initial pressure, between 0.1 and 0.15 mm Hg, was reduced in proportion to the square root of the molecular weight and determined at the end of time t . The latter is therefore given by $M = 32(t/t_0)^2$, where t_0 and t are the observed times of effusion respectively for O_2 and the gas studied. In the method recommended the final time is that in which the ratio of electric resistances of two Pyrani gages returns to a particular value. (auth)

2858

ETHYLENE AND ETHYL ALCOHOL AS QUENCHING AGENTS IN EXTERNAL-CATHODE GEIGER COUNTERS.

Robert L. Chasson and Merritt L. MacKnight. Rev. Sci. Instruments **24**, 212-13 (1953) Mar.

The manufacturing yield of acceptable external-cathode counters has been found to be 67% with ethylene-argon filling and 94% with ethyl alcohol-argon filling. Over 90% of the tubes that did not perform well with ethylene-A performed well when refilled with alcohol-A. A total of 444 counters enter into these statistics. Twenty rejected ethylene tubes were alternately refilled and tested with alcohol-A and ethylene-A. Results of several of such test cycles showed repeated success with alcohol and failure with ethylene. Deterioration of quality with counting age was extremely nonuniform for ethylene tubes, and at the end of their useful lifetime they displayed extreme multiple pulsing but no serious damage to the plateau slope. A temporary return to normal operating characteristics was observed for these tubes after inactive periods. This behavior is explained in terms of the Paetow effect. (auth)

2859

CONTROL SYSTEM FOR A BALLOON-BORNE CLOUD CHAMBER. Irving L. Kofsky. Rev. Sci. Instruments **24**, 227-8 (1953) Mar.

A schematic diagram and description are given of the control system for a cloud chamber which the author has built for the observation of cosmic radiation at $\sim 15 \text{ g/cm}^2$ residual atmospheric pressure. (L.M.T.)

2860

MOMENTUM DETERMINATION FROM CLOUD-CHAMBER PHOTOGRAPHS IN AXIALLY SYMMETRICAL MAGNETIC FIELDS. A. M. Cormack. Rev. Sci. Instruments **24**, 232 (1953) Mar.

Most methods of determining the momenta of charged particles from cloud-chamber photographs of their tracks in magnetic fields depend on the assumption that the magnetic field is uniform and hence that the radius of curvature of the track is constant. Various methods are then used to determine the radius of curvature and hence the momentum. The method described in this note does not require that the field be uniform, but only that it shall be symmetrical about the cloud-chamber axis; this makes possible the use of much larger magnetic fields. (auth)

2861

CALIBRATION BY A REACTIVITY MEASUREMENT OF BORON IONIZATION CHAMBERS INDICATING PILE POWER. Victor Ralevski. Compt. rend. **236**, 1251-2 (1953) Mar. 23. (In French)

The multiplication factor of a subcritical pile is measured. From the mass of U contained in the structure is deduced the number of fissions per unit of time and hence the power. A neutron detector can thereby be calibrated to indicate the power level. (tr-auth)

2862

DEVELOPMENT OF A NEW METHOD FOR THE ABSOLUTE DETERMINATION OF β -RAY ENERGIES. H. Craig and C. F. Dietrich. Proc. Phys. Soc. (London) **B66**, 201-15 (1953) Mar.

A magnetic electron lens working at unit magnification is described in which the image-rotating property is used to produce two line images by reversal of the current through the lens windings. It is shown how the specific momentum (H_0) of the focused electrons may be found from a knowledge of the angle between the two lines, the mean current, and the number of turns on the lens. This is followed by a theoretical investigation of the optimum conditions necessary to obtain the highest accuracy. A pilot experiment in which the formula for (H_0) is tested, gave an accuracy within 1 to 700 for the Th F line. Further experimental work was carried out on a second lens to test the optimum conditions referred to above. It was shown

that the angle between the lines could be determined to an accuracy within 1 in 30,000. It is further explained how by use of a new optical device, and on the basis of 25 readings, the angle between the lines could be established to an accuracy within 1 in 10^5 . The second lens of which the number of turns is not known was used to investigate the specific momentum of the I, F, and A lines of Th(B + C). In this application of the method the lens was calibrated by means of the I and F lines of ThB, giving the ratio of the two specific momenta, while the difference was obtained from x-ray data. An absolute determination of the A line is described. 15 references. (auth)

2863

MEASUREMENT OF MOISTURE CONTENT BY NEUTRON COUNTING. J. Sharpe. Brit. J. Appl. Phys. **4**, 93-4 (1953) Mar.

The method reported here is similar to the method used by Spinks, Lane, and Torchinsky (Can. J. Technol. **29**, 371 (1951)) who measured the β activity induced in an In foil placed above a Cd-shielded paraffin-wax cylinder separated a given distance from a 250 mc Ra-Be source, the whole device being imbedded in the soil. In this experiment, a BF₃ proportional counter replaces the In foil and Cd-shielded paraffin wax, and the optimum position of the source with regard to the counter is determined. The results obtained with the BF₃ counter show considerable gain in sensitivity and discrimination over the In-foil method. (L.M.T.)

MESONS

2864

Atomic Energy Research Establishment, Harwell, Berks, (England)

THE SPECTRUM OF THE RADIATION EMITTED DURING μ -MESON CAPTURE BY CARBON. F. D. S. Butement. Nov. 18, 1952. 4p. (AERE-C/R-1061)

The spectrum of the electromagnetic radiation emitted during cosmic-ray μ -meson capture by C atoms has been measured on a γ -scintillation spectrometer. The spectrum shows radiation of energy about 80 kev., corresponding to the 2p-1s transition of a μ -meson in C. (auth)

2865

MESON PRODUCTION BY COLLISION OF HIGH-ENERGY NUCLEONS. Klaus Gottstein and Martin Teucher. Z. Naturforsch. **a8**, 120-6 (1953) Feb.-Mar. (In German)

The energy and angular distributions of prongs of a type 0 + 2p star are investigated and compared with the predictions of Heisenberg's collision-wave theory. (tr-auth)

2866

INTERACTION WITH NUCLEI AND PRODUCTION OF π MESONS. E. Clementel and G. Puppi. Nuovo cimento **(9) 10**, 198-214 (1953) Mar. 1. (In Italian)

Various phenomena connected with the absorption, scattering, and production of π mesons in nuclear matter have been investigated using an optical model for the nucleus. With the existing experimental data it is possible to establish that up to about 100 Mev the predominant process is absorption, while for energies above this value scattering predominates. In the production of mesons in nuclei by protons, account has been taken of the energy loss due to the elastic collisions of protons, which is particularly important near the threshold of production. In this way the authors are able to explain the observed saturation in the forward-production cross section. The optical model gives an $A^{2/3}$ dependence for the backward production cross section. In photoproduction, the absorption of mesons does not alter the angular dependence of the differential cross section in nuclear matter, and the yield of charged mesons increases more rapidly than the $A^{2/3}$ law, if an absorption mean free path of the order of $2r_0$ is assumed ($R =$

$r_0 A^{1/3}$). For mesons of about 60 Mev, results are consistent with the experimental data if an absorption mean free path between $2r_0$ and $3r_0$ is chosen. (auth)

2867

OBSERVATION OF THE DECAY AT REST OF A HEAVY PARTICLE. A. Bonetti, R. Levi Setti, M. Panetti, and G. Tomasini. Nuovo cimento (9) 10, 345-6 (1953) Mar. 1. (In English)

An event observed in Ilford G5 emulsion exposed at 20,000 m altitude is illustrated. A charged particle of 2500 ± 345 me mass stops after traversing $15,760 \mu$ of the emulsion and gives rise to a single fast secondary. The latter could not be identified. (G.Y.)

2868

DAMPING CORRECTIONS IN THE PHOTO-MESON PROCESS. G. R. Allcock. Proc. Phys. Soc. (London) A66, 233-7 (1953) Mar. 1.

An examination is made of the effect of damping on the photoproduction of pseudoscalar charged and neutral π mesons from protons, ignoring all self-energy effects. In the case of pseudoscalar coupling the damping corrections are large, but do not greatly remedy the disagreement of second-order perturbation theory with experiment; while for pseudovector coupling damping effects are unimportant. 17 references. (auth)

2869

NUCLEAR CAPTURE OF NEGATIVE μ MESONS IN PHOTOGRAPHIC EMULSIONS. H. Morinaga and W. F. Fry. Nuovo cimento (9) 10, 308-18 (1953) Mar. 1. (In English)

Ilford C2 emulsions were exposed to negative μ mesons from the University of Chicago cyclotron. The μ mesons were separated from the π mesons of the same momentum by utilizing the difference in the ranges of the μ and π mesons in Cu. About 24,000 meson tracks which stopped in the emulsion have been studied. In 591 cases (2.4%) the stopped meson is accompanied by the emission of one or more charged particles. A large percentage of these stars are one-prong. The energy distributions of protons and α particles from the one-prong stars have been obtained. The general shapes of the energy distribution curves indicate that the protons and α particles from these stars are mostly evaporation products from a moderately excited nucleus such as Ag or Br. The average energy of the charged particles from these stars is lower than from negative π -meson stars. The negative π -meson contamination is found to be less than 0.3%. In several cases the characteristics of the star make it possible to identify the nucleus in which the meson was captured and to evaluate the energy given to the nucleus. In these cases the energy given to the nucleus is found sometimes to be as high as 45 Mev. (auth)

2870

MAXIMUM ENERGY OF THE NEUTRONS FROM CAPTURE OF NEGATIVE μ MESONS IN IRON NUCLEI. L. Niklas and K. H. Lauterjung. Z. Naturforsch. a8, 214-16 (1953) Feb.-Mar. (In German)

Fast neutrons produced by the capture of cosmic μ mesons in Fe were detected by the collision protons emitted from paraffin. Emission and absorption curves of these collision protons are presented, showing the occurrence of neutron energies up to ~ 45 Mev. (G.Y.)

NEUTRONS

2871

TOTAL COLLISION CROSS SECTIONS OF SEVERAL ELEMENTS FOR 14-MEV NEUTRONS. M. Ageno, G. Cortellessa, and R. Querzoli. Nuovo cimento (9) 10, 281-99 (1953) Mar. 1. (In Italian)

The total cross sections of Al, O, P, S, Cu, Au, Hg, Pb, and Bi were measured in good geometry for 14-Mev neutrons. A detailed discussion is given of the corrections of transmission data for diffused slow neutrons. No systematic deviations from the one-third-power law of the atomic weight were found for nuclear radii, and results are in general agreement, within the limit of standard errors of about 2%, with the statistical theory of Feshbach and Weisskopf. (auth)

NUCLEAR PHYSICS

2872

Wisconsin Univ.

NUCLEON CONFIGURATIONS FROM NUCLEAR QUADRUPOLE MOMENTS. W. G. Holladay and R. G. Sachs. [1953] 6p. (AECU-2447)

Attention is called to the fact that the nuclear quadrupole moment gives information concerning the configuration of odd nucleons for odd-A nuclei if the Mayer-Jensen shell model is taken literally. A tentative prediction of the signs of unmeasured quadrupole moments is made on the basis of configurations proposed by Klinkenberg. (auth)

2873

Oak Ridge National Lab.

PHYSICS DIVISION QUARTERLY PROGRESS REPORT FOR PERIOD ENDING DECEMBER 20, 1952. Issued Apr. 7, 1953. 29p. (ORNL-1496)

Studies reported include: Li^7 and H^3 reactions with the Cockcroft-Walton He^3 beam; angular distributions of neutrons scattered from N; coincidence spectroscopy of γ rays from Ta^{181} ; Os^{181} decay scheme; modification of apparatus for γ -ray angular correlations; chemical separation of 0.82-sec Pb^{207m} from Bi^{207} ; tritium-produced activities in neutron-irradiated Li compounds; magnetic moments of constituents of Ni_3Fe , Fe_3C , and Ni_3Mn alloys by neutron diffraction; magnetic scattering of neutrons by Nd and Er; neutron transmission of Ni and Ni^{62} ; a proposed setup for study of neutron decay; production of polarized particles in nuclear reactions; calculation of the electrodynamic part of the level shift in H; and effect of finite de Broglie wavelength in β decay. (For previous period see ORNL-1415.) (L.M.T.)

2874

MAGNETIC MOMENTS OF ODD-ODD NUCLEI AND THE STRONG SPIN-ORBIT COUPLING SHELL MODEL. H. M. Schwartz. Phys. Rev. 89, 1293-4 (1953) Mar. 15.

Using the extreme jj coupling model and employing semi-empirical g factors, magnetic moments are computed for those odd-odd nuclei for which I and μ measurements exist. The results are suggestive as to relevant coupling properties of such nuclei, but as yet not sufficient for definite conclusions. As an aid to possible future work, this note includes a tabulation of computed magnetic moments for some odd-odd nuclei for which tentative spin assignments are possible, employing both free-nucleon and semi-empirical g factors and based on pure LS and jj two-nucleon states. (auth)

NUCLEAR PROPERTIES

2875

Wisconsin Univ.

TOTAL FAST NEUTRON CROSS SECTIONS OF Co, Ga, Se, Cd, Te, Pt, Au, Hg, and Th. M. Walt, R. L. Becker, A. Okazaki, and R. E. Fields. [1952] 9p. (AECU-2441)

The total neutron cross sections of Co, Ga, Se, Cd, Te, Pt, Au, Hg, and Th were measured as a function of neutron energy from 0.1 to 3 Mev. An estimate of the error caused by neutrons scattered into the detector was made by measuring the apparent cross section as a function of sample

diameter. The results give additional evidence that, neglecting resonance structure, total neutron cross-section curves have characteristic shapes which change slowly with atomic weight. (auth)

2875

Argonne National Lab.

Thermal Neutron-Proton Capture. S. P. Harris, C. O. Muehlhauser, D. Rose, H. P. Schroeder, G. E. Thomas, Jr., and S. Wexler. Dec. 30, 1952. 14p. (AECU-2442; UAC-701)

Measurement of the thermal-neutron-capture cross section of H has been effected by a comparison with B, using the technique of pile oscillation. The 2200 m/sec value obtained, 0.332 b, has a 2% uncertainty due primarily to the effect of neutron moderation by H. However, the result indicates an exchange-moment contribution to the cross section $\sim 6 \pm 3\%$. (auth)

2877

Argonne National Lab.

The Photo-Disintegration Cross Section of Beryllium at 2.185 Mev. Bernard Hammermesh and Clyde Kimball. Feb. 1953. 8p. (AECU-2449; UAC-717)

The cross section for the photo-disintegration of Be^9 at 2.185 Mev has been measured using γ rays which follow the β decay of Pr^{144} . A value of $3.9 \times 10^{-28} \text{ cm}^2$ was found in reasonably good agreement with the valence neutron model. This value is lower than the values at 1.81 and 2.50 Mev in agreement with the theoretical prediction that a minimum value of the cross section should be found near 2.2 Mev. (auth)

2878

Purdue Univ.

Evidence of a Mixed E1 + M2 Transition and the Angular Momenta of the Sr^{88} Levels. Rolf M. Steffen. [1953] 6p. (AECU-2462)

The directional correlation of Sr^{88} γ rays was measured by using one arrangement in which the NaI detector was shielded for almost uniform local quantum efficiency, and another arrangement in which the whole area of the crystal was exposed. The directional polarization coefficients indicate an assignment of 3, 2, and 0 to the states of the Sr^{88} nucleus, and together with the conversion data, characterize the first ($3 \rightarrow 2$) transition as electric dipole with 0.015 to 0.007% magnetic quadrupole, the two radiations being in phase. The second ($2 \rightarrow 0$) transition is by pure electric quadrupole radiation. (L.M.T.)

2879

Atomic Energy Research Establishment, Harwell, Berks (England)

Bibliography on Fission, Supplement 1: Covering References up to September 1952. Oct. 1952. 9p. (AERE-Inf/Bib-76(suppl. 1))

A list is presented of 50 references on fission collected from published literature and 35 from unclassified reports, covering references up to Sept. 1952. (C.H.)

2880

Oak Ridge National Lab.

Internal Conversion—X-Ray Angular Correlations. R. K. Osborn and M. E. Rose. Issued Apr. 7, 1953. 8p. (ORNL-1499)

In the usual theory and application of angular correlations (γ -rays, internal-conversion electrons, etc., emitted in cascade by a nucleus) it is, in general, necessary that the magnetic perturbations of the intermediate nuclear states be sufficiently weak in order that when the nucleus emits the second radiation it has not "forgotten" the state it was left in by the first radiation. Because of the difficulty of eliminating these perturbing magnetic fields in certain cases, it was felt to be worthwhile to determine the possibility of

an observable angular correlation between internal-conversion electrons and the x ray emitted subsequently as the atom returns to the ground state. The observational feasibility of this angular correlation is found to be improbable. (L.M.T.)

2881

Nuclear Spin and Magnetic Moment of Radioactive Cobalt 57. J. M. Baker, B. Bleaney, K. D. Bowers, P. F. D. Shaw, and R. S. Trenam. Proc. Phys. Soc. (London) A66, 305-6 (1953) Mar. 1.

From the hyperfine structure observed in a paramagnetic resonance spectrum, the nuclear spin of Co^{57} has been determined as $\frac{1}{2}$, and the magnetic moment as $4.6 \pm 0.2 \text{ n.m.}$ The Co^{57} was made by the reaction $\text{Fe}^{56}(\text{d},\text{n})\text{Co}^{57}$, using 18-Mev deuterons produced in the Birmingham cyclotron. (auth)

2882

Nuclear Magnetic Moment of Pr^{141} from the Hyperfine Structure of Pr^{II} . Peter Brix. Phys. Rev. 89, 1245-6 (1953) Mar. 15.

From the hyperfine structure of Pr^{II} lines measured by White the magnetic interaction constant $a_{6s} = 0.416 \pm 0.015 \text{ cm}^{-1}$ has been evaluated for the 6s electron in the configuration $4f^3(^1\text{I})6s$. Application of the formula of Goudsmit and Fermi-Segrè yields the nuclear magnetic moment $\mu(\text{Pr}^{141}) = +3.9 \pm 0.3 \text{ n.m.}$ (auth)

2883

Relativistic Corrections to the Magnetic Moments of Nuclear Particles. G. Breit and R. M. Thaler. Phys. Rev. 89, 1177-86 (1953) Mar. 15. (cf. NSA 7-1502)

A re-examination of the problem is reported. The results for the vector and scalar cases in the case of the deuteron are explained in terms of known correction factors for the one-body problem. For the vector equation part of the result is caused by an induction effect which is the meson theoretic generalization of Faraday's law of induction. In the scalar case the relation to the one-body result is made in a form employing an effective change in mass caused by the presence of the scalar. These interpretations are substantiated by an analysis in terms of plane waves. Simple forms are obtained for one particle in a pseudoscalar field and a tentative application to the deuteron is made and criticized. 17 references. (auth)

NUCLEAR TRANSFORMATION

2884

The D^3H and D^3He Reactions Below 45 KeV. R. G. Jarvis and D. Roaf. Proc. Phys. Soc. (London) A66, 310 (1953) Mar. 1.

The disintegrations which result from bombarding the mirror nuclei H^3 and He^3 with low-energy deuterons have been investigated using thin gas targets and detecting the α particles in nuclear photographic emulsions. The angular distribution in the c.m. system of the α particles for $\text{D}-\text{H}^3$ was isotropic within the errors of measurement. Owing to the low yield the $\text{D}-\text{He}^3$ was measured at one angle only and its cross section was calculated assuming an isotropic angular distribution. The cross sections of both reactions are given. (auth)

2885

Evidence for the Excited State of He^5 in the $\text{Li}^7(\text{d},\alpha)\text{He}^5$ Reaction. Pierre Cuer and Jean-Jacques Jung. Compt. rend. 236, 1252-4 (1953) Mar. 23. (In French)

The $\text{Li}^7(\text{d},\alpha)\text{He}^5$ reaction was studied in very good geometry by the photographic method with several experimental arrangements adapted to the Strasbourg accelerator. $E_d = 0.98 \text{ Mev}$. The mass of $\text{He}^5 = \text{He}^4 + \text{n}_0^1 + 0.9 \pm 0.1 \text{ Mev}$

is in accord with that from other reactions. Its width is $\sim 0.3 \pm 0.1$ Mev. An excited state at $\sim 2.5 \pm 0.2$ Mev with a width of $\sim 1.5 \pm 0.3$ Mev was found. No states of higher excitation could be found in this reaction. (tr-auth)

2885

PHOTOFISSION OF THE Li^6 NUCLEUS INTO DEUTERON AND α PARTICLES. Peter Jensen and Kurt Gis. *Z. Naturforsch.* **a8**, 137-41(1953) Feb.-Mar. (In German)

Research on detection of the $\text{Li}^6(\gamma, d)\text{He}^4$ reaction with a proportional counter showed that the cross section for the 2.62-Mev ThC'' quanta is $< 3.5 \times 10^{-20} \text{ cm}^2$ with 99% probability. The smallness of the cross section, which has also been found for photons of other energies, is related to the properties of the Li^6 nucleus. (tr-auth)

2887

NUCLEAR REACTIONS WITH 21-MEV He^3 IN A CYCLOTRON. D. N. Kundu, T. W. Donaven, M. L. Pool, and John K. Long. *Phys. Rev.* **89**, 1200-2(1953) Mar. 15.

He^3 ions were accelerated to a maximum energy of 21 Mev. Bombardment of Be, C, O, and Ni led to numerous known activities. The relative cross sections of the He^3 reactions involving O and Ni nuclei are evaluated. The half lives of C^{11} and Zn^{62} were found to be 20.74 ± 0.10 min and 8.4 ± 0.2 hr, respectively. (auth)

2888

NUCLEAR PHOTOEFFECT IN BERYLLIUM AT HIGH ENERGIES. Herbert Überall. *Z. Naturforsch.* **a8**, 142-8 (1953) Feb.-Mar.

The variation of cross section with energy and the angular distribution of neutrons emitted in the $\text{Be}^9(\gamma, n)$ reaction have been studied in the energy range 20 to 200 Mev. The $^2\text{P}_{1/2}$ state of a rectangular potential well with $r_0 = 5 \times 10^{-3}$ cm and $V_0 = 12.09$ Mev was used as ground state. The lower limit of the energy region discussed was determined by considerations the validity of the Born approximation. The upper limit resulted from the neglect of relativistic terms. The angular distribution contained a preponderant term proportion to $\sin^2\theta$, a small isotropic term, and a negligible additional term. The total cross section is of the order of magnitude of 10^{-28} cm^2 at 20 Mev and decreases rapidly, passing through several null points and maxima to 10^{-30} cm^2 . (tr-auth)

2889

THE ABSOLUTE DETERMINATION OF RESONANT ENERGIES FOR THE RADIATIVE CAPTURE OF PROTONS BY BORON; CARBON; FLUORINE; MAGNESIUM, AND ALUMINUM IN THE ENERGY RANGE BELOW 500 KEV. S. E. Hunt and W. M. Jones. *Phys. Rev.* **89**, 1283-7(1953) Mar. 15.

An absolute electrostatic analyzer of deflecting angle $\pi/2\sqrt{2}$ radians has been used to measure and stabilize the energy of the proton beam from an air-insulated electrostatic generator. The following resonant energies for proton capture by some of the light elements have been measured: $\text{B}^{11}(\text{p}, \gamma)\text{C}^{12}$, 163.8 ± 0.03 kev; $\text{C}^{12}(\text{p}, \gamma)\text{N}^{13}$, 456.8 ± 0.5 kev; $\text{F}^{19}(\text{p}, \gamma)\text{N}^{20*}$, 224.4 ± 0.4 kev; $\text{Mg}^{26}(\text{p}, \gamma)\text{Al}^{27}$, 314.8 ± 0.5 , 338.5 ± 0.5 , 389.4 ± 0.5 , 436.5 ± 0.4 , 454.2 ± 0.3 , 484.0 ± 1.0 kev; $\text{Mg}^{24}(\text{p}, \gamma)\text{Al}^{25*}$, 418.0 ± 0.5 kev; and $\text{Al}^{27}(\text{p}, \gamma)\text{Si}^{28}$, 226.3 ± 1.5 , 294.1 ± 0.5 , 325.6 ± 0.4 , 404.7 ± 0.4 , 438.5 ± 0.5 , 504.0 ± 0.6 kev. The high energy resolution of 1000 obtained has made accurate determination of the half widths of these resonance possible. (auth)

PARTICLE ACCELERATORS

2890

Radiation Lab., Univ. of Calif., Berkeley

SUMMARY OF RESEARCH PROGRESS MEETING OF JANUARY 15, 1953. Sergey Shewchuk. Feb. 10, 1953. 8p. (UCRL-2107)

Cosmotron and High-Energy Accelerators Discussed at Brookhaven Accelerator Conference. E. Lofgren. Some general design features and operating characteristics of the cosmotron are briefly discussed. The design dimensions for various proposed high-energy accelerators using the strong-focusing principle are listed for three groups according to size. Problems in Very High-Energy Accelerator Theory Discussed at Brookhaven Conference. D. L. Judd. A review of the basic idea of alternating-gradient focusing is presented in order to discuss the major problem encountered in the design of proton synchrotrons (the resonance effect). The two approaches to the problem are discussed: (1) separate guide and focusing fields, and (2) varying the frequencies of oscillation so rapidly as to smear out the representative point over a large area. (L.M.T.)

2891

ELIMINATION OF THE EFFECTS OF IMPERFECT ALIGNMENT IN THE STRONG-FOCUSING COSMOTRON. Joseph Seiden. *Compt. rend.* **236**, 1145-6(1953) Mar. 16. (In French)

Proper choice of operating parameters of the cosmotron is shown to eliminate the loss of particles due to defects in alignment of the magnetic sectors. (tr-auth)

2892

THE COCKCROFT-WALTON VOLTAGE MULTIPLYING CIRCUIT. Edgar Everhart and Paul Lorrain. *Rev. Sci. Instruments* **24**, 221-6(1953) Mar.

The conventional Cockcroft-Walton voltage multiplying circuit is studied considering it as a transmission line. It is shown that, even when no direct current is drawn from the high-voltage electrode, there is an important loss in output voltage caused by circulating currents in the stray capacitances. This loss of voltage is independent of the supply frequency. Formulas are developed for the voltage efficiency resulting from a given choice of capacitor size and number of stages. Two modifications of the Cockcroft-Walton circuit which improve the voltage efficiency are suggested and analyzed. The first of these involves a loading coil at the high-voltage end of the line. The second involves the addition of inductors in series with each of the capacitors of the circuit. (auth)

RADIATION ABSORPTION AND SCATTERING

2893

Wisconsin Univ.

ELASTIC SCATTERING OF ALPHA-PARTICLES BY CARBON. Richard William Hill. [1952] 20p. (AECU-2437)

The $\text{C}^{12}(\alpha, \alpha)\text{C}^{12}$ differential scattering cross sections were measured in a gas scattering chamber at $\theta(\text{c.m.}) = 171.0, 147.2, 125.5$, and 92.0° with α particles accelerated in the Wisconsin electrostatic generator. Cross sections were measured at α -particle energies from 0.5 to 4.0 Mev. For zero-spin nuclei bombarded by zero-spin particles, each partial wave contributing to the cross section vanishes at some angle except that for $l = 0$. The P wave vanishes at 90.0° , the D wave at 125.3° , the F wave at 140.8° , and the G wave at 149.5° . Thus by observing the cross sections near these angles it was possible to determine the J values and parities of the levels. Analyzing the data by means of the Wigner-Eisenbud one-level approximation to determine the widths and resonant energies confirmed the qualitative characterization of the levels. With the O^{16} ground state as the energy zero, the J values, parities, and excitation energies of the two levels observed are: $J = 1^-$ at 9.58 Mev and $J = 2^+$ at 9.835 Mev. The uncertainty in these energies is about 10 kev. The reduced width of the P resonance is approximately 100% of the single-particle width, and that of the D resonance is 0.15%. (auth)

2894

Wisconsin Univ.

SCATTERING OF NEUTRONS BY DEUTERONS. R. K. Adair, A. Okazaki, and M. Wait. [1952] 28p. (AECU-2440)

Angular distributions and total cross sections of neutrons scattered by deuterons were measured at various neutron energies ranging from 220 kev to 3 Mev. A proportional counter filled with deuterium was irradiated with mono-energetic fast neutrons produced by bombarding thin Li and T-filled Zr targets with protons from the electrostatic generator. Angular distributions of the neutrons scattered by deuterons were determined by measuring the distribution in energy of the recoiling deuterons with a differential discriminator. Total n-d cross sections were measured by comparing the neutron transmission of heavy water with ordinary water. Phase shifts determined from an analysis of the data were not in agreement with theoretical conclusions of Buckingham and Massey, or of Verde. (auth)

2895

Wisconsin Univ.

ELASTIC SCATTERING OF ALPHA-PARTICLES BY OXYGEN. John R. Cameron. [1953] 21p. (AECU-2446)

The differential cross sections for elastic scattering of α particles by O¹⁶ were measured in a gas scattering chamber using α particles accelerated in an electrostatic generator over the energy region from 0.94 to 4.0 Mev. Cross sections were measured at θ (c.m.) = 168.0; 140.1; 124.6; and 90.0°. The resonances were analyzed using the Wigner-Eisenbud one-level approximation to determine the width and resonant energy of each resonance. Five scattering anomalies were observed which correspond to excited states of Ne²⁰ with the following energies, angular momenta, and parities: 6.738 Mev, $J = 0^+$; 7.182 Mev, $J = 3^-$; 7.218 Mev, $J = 0^+$; 7.450 Mev, $J = 2^+$; and 7.854 Mev, $J = 2^+$. (auth)

2896

National Bureau of Standards

AN EXPERIMENT ON GAMMA-RAY BACKSCATTERING. Evans Hayward and John H. Hubbell. Feb. 10, 1953. 71p. (NBS-2264)

The backscattering of essentially monochromatic γ radiation from infinite slabs of steel wool and wood was investigated. In one case intensity measurements were made with a Geiger counter for various angles of intensity and deflection, the qualitative result obtained being that the counting rate increases as the total deflection that the photon must undergo, decreases. The second part of the experiment consisted of looking at the backscattered radiation with a NaI scintillation spectrometer and by this means the first scattered beam and a diffuse component were identified. The data consist simply of pulse-height distributions and no attempt is made to obtain a backscattering coefficient. Finally the pulse-height distributions produced by photons scattered from infinite targets of Al, Cu, Sn, and Pb were measured to obtain a qualitative indication of how the amount and energy of backscattered radiation depends on Z. (L.M.T.)

2897

Columbia Univ.

ELASTIC PION-DEUTERON SCATTERING. R. Arase, Gerson Goldhaber and S. Goldhaber. Feb. 1953. 7p. (NYO-3201)

By soaking 600 μ Ilford G5 emulsions at 13°C for 2 hours, ~ 1 g D₂O/cm³ of dry emulsion was introduced which is equivalent to 0.11 g of D/cm³ of loaded emulsion. These emulsions as well as non-loaded emulsions were exposed to a total flux of $\sim 3 \times 10^4$ mesons/cm² in the 140-Mev magnetically separated π^- beam of the Nevis Cyclotron. The emulsions were scanned by area and an effective path length (L_{eff}) was obtained after correcting for a 10% μ -meson and

electron contamination in the beam and 85% scanning efficiency. $\pi^- + D$ scatterings were identified by examining all one-prong scattering events according to the following three criteria: the coplanarity of the three prongs, the angular correlation between the scattered meson and the recoil prong, and the correlation between the range and angle of the recoil prongs. (auth)

2898

New York Operations Office, AEC

BOUNDS ON A HALF-VALUE LAYER AS A FUNCTION OF IONIZATION MEASUREMENT PRECISION. Leonard R. Solon and Hanson Blatz. Apr. 1953. 5p. (NYO-4521)

An expression is established yielding the bounds on a half-value layer when an ionization chamber measurement is known with a given precision. (auth)

2899

Radiation Lab., Univ. of Calif., Berkeley

DIFFERENTIAL CROSS SECTION FOR THE ELASTIC SCATTERING OF 32 MEV PROTONS BY DEUTERONS (thesis). Val J. Ashby. Jan. 28, 1953. 80p. (UCRL-2091)

The angular variation of the differential cross section for the elastic scattering of 32-Mev protons by deuterons has been measured from 22.4 to 150° in the c.m. system. The measurement was performed using a differential-range, proportional-counter telescope of which a detailed analysis has been made. The results are in general agreement with those obtained at both higher and lower energies by other workers. (auth)

2900

MOLIÈRE'S THEORY OF MULTIPLE SCATTERING. H. A. Bethe. Phys. Rev. 89, 1256-66(1953) Mar. 15.

Molière's theory of multiple scattering of electrons and other charged particles is here derived in a mathematically simpler way. The differential-scattering law enters the theory only through a single parameter, the screening angle χ^a . The angular distribution, except for the absolute scale of angles, depends again only on a single parameter b. It is shown that b depends essentially only on the thickness of the scattering foil in g/cm², and is nearly independent of Z. The transition to single scattering is re-investigated. An asymptotic formula is obtained which agrees essentially with that of Molière, Snyder, and Scott, but which remains accurate down to smaller angles. The theory of Goudsmit and Saunderson has a close quantitative relation to that of Molière, and a good approximation to their distribution function can be obtained by multiplying Molière's function by $(\theta/\sin\theta)$. This relation holds until the scattering angles become so large that only very few terms in the series of Goudsmit and Saunderson need to be taken into account. (auth)

2901

THE DIFFERENTIAL AND TOTAL NEUTRON SCATTERING CROSS SECTIONS OF THE DEUTERON IN THE ENERGY RANGE 0.1 TO 1.0 MEV. P. R. Tunnicliffe. Phys. Rev. 89, 1247-51(1953) Mar. 15.

The angular distribution of neutrons scattered by deuterons has been investigated by proportional-counter techniques in the energy range 0.1 to 1.0 Mev. The distribution shows a very marked anisotropy at the higher energies which is still appreciable at 135 kev. Values for the total scattering cross sections are in agreement with earlier data down to 446 kev but apparently increase above the accepted value for the unbound thermal cross section. 27 references. (auth)

2902

THE ANGULAR CORRELATION OF THE PROTONS AND γ -RADIATION FROM THE REACTION $^6\text{Li}(d,p)^7\text{Li}^* \gamma^7\text{Li}$. A. J. Salmon and E. K. Inall. Proc. Phys. Soc. (London) A66, 297-303(1953) Mar. 1.

In order to provide information on the first excited state

of Li^7 the angular correlation between the protons and the γ radiation from the reaction $\text{Li}^6(\text{d},\text{p})\text{Li}^{7*}\gamma\text{Li}^7$ has been studied. An isotropic angular correlation was observed. The angular correlations, predicted theoretically, for the most likely transitions in this reaction have been determined. It is shown that an isotropic angular correlation indicates that, very probably, $J = \frac{1}{2}$ for this state. 18 references. (auth)

2903

INELASTIC COLLISIONS OF ELECTRONS IN HELIUM AND TOWNSEND'S IONIZATION COEFFICIENT. I. Abdelnabi and H. S. W. Massey. Proc. Phys. Soc. (London) **A66**, 288-96 (1953) Mar. 1.

It is pointed out that the accuracy of the cross sections observed by Maier-Leibniz for the excitation of He by slow electrons may be tested by using them to calculate the Townsend ionization coefficients α and comparing the results of such calculations with observed values. Information about the reliability of the difficult measurements of excitation cross sections is essential to check attempts made to develop a satisfactory theory. To carry out this test it is necessary to extend and to some extent refine the work of Smit on the velocity distribution of electrons in He diffusing under the action of a uniform electric field F when inelastic collisions are allowed for. This has been done and numerical results have been obtained for $F/p = 10$ and 20 v/cm/mm Hg . The ionization coefficient has been measured for the higher values of F/p and agrees quite well with that calculated when Maier-Leibniz's cross sections are used. The sensitivity of this test of the cross sections was examined by calculating α assuming that Maier-Leibniz's values were respectively twice and one-half the correct value. It was found that the calculated value of α is nearly proportional to the size of the assumed excitation cross section (it was assumed throughout that the ionization cross section is given correctly from Smit's observations). It is concluded that the observations of Maier-Leibniz may be used for checking theoretical determination of excitation cross sections in He. (auth)

2904

THE APPLICATION OF VARIATIONAL METHODS TO SCATTERING BY IONS. I. THE ELASTIC SCATTERING OF ELECTRONS BY HELIUM IONS. B. H. Bransden and A. Dalgarno. Proc. Phys. Soc. (London) **A66**, 268-77 (1953) Mar. 1.

The variational method is used to investigate the elastic scattering of slow electrons by the positive He ion. Zero-order phases and wave functions found by this method are shown to agree, in general, with those found by numerical integrations of the wave equation, both when the wave function is of the 'one-body' type and when it is of the correct symmetry. The inclusion in the trial wave function of a term involving the distance between the two electrons is found to lead to smaller phases. Detailed results are given for energies of the incident electron in the range 3 to 60 ev. (auth)

2905

THE ELASTIC SCATTERING OF NEUTRONS BY TRITONS AT 14 MEV. P. Swan. Proc. Phys. Soc. (London) **A66**, 238-48 (1953) Mar. 1.

The theory of n-t scattering has been worked out, using Wheeler's resonating group-structure method, and applied to a neutron energy of 14 Mev for four types of nuclear interaction: an ordinary force, an exchange force of Majorana-Heisenberg type, a symmetrical exchange force, and the Serber exchange mixture. The nuclear potential is taken in the gaussian form $V_0 \exp(-\mu r^2)$ and the corresponding two-body ground-state wave function as $N_0 \exp(-\frac{1}{4}\mu r^2)$. The resulting integro-differential equations for scattering are solved by variational methods. The symmetric and

Majorana-Heisenberg forces give the right general shape for the angular distribution of scattering, but the ordinary and Serber forces give a rather higher peak of back scattering than indicated by the experiments of Coon, Bockelman, and Barschall at 14 Mev. The measurements appear to favor forces of a symmetrical exchange type as against an ordinary force type. (auth)

2906

MEASUREMENTS OF THE ENERGY LOSS DISTRIBUTION FOR MINIMUM IONIZING ELECTRONS IN A PROPORTIONAL COUNTER. D. West. Proc. Phys. Soc. (London) **A66**, 306-8 (1953) Mar. 1.

This experiment is an extension of that of Rothwell (Proc. Phys. Soc. (London) **B64**, 911 (1951)) who measured the energy-loss distribution of relativistic electrons in A and Kr. The same experimental method is used, but measurements for 1.3-Mev electrons are made using Ne, CO_2 , and CH_4 as well as Kr and A, and a greater range of pressures is covered. The experimental widths of the energy loss distribution in He, Ne, and A lie along the same curve when plotted against $\xi/I_0 Z$ where I_0 is the mean ionization potential of electrons in an atom of atomic number Z, and the parameter ξ is an energy, such that, on the average, one δ ray of energy $>\xi$ is produced in the length of track examined. (L.M.T.)

2907

AN INVESTIGATION OF (d,p) STRIPPING REACTIONS. I. APPARATUS AND RESULTS FOR ALUMINIUM. II. RESULTS FOR THE ISOTOPES OF MAGNESIUM. J. R. Holt and T. N. Marsham. Proc. Phys. Soc. (London) **A66**, 249-67 (1953) Mar. 1. (cf. NSA 6-6165)

An apparatus is described which enables angular distribution measurements to be carried out within the angular region -5 to $+140^\circ$ on disintegration particles of long range. The differential range spectrum is measured at each angle by the use of a triple proportional counter of novel design. Measurements are reported for the two proton groups of longest range produced in the reaction $\text{Al}^{27}(\text{d},\text{p})\text{Al}^{28}$ with a deuteron energy of 8 Mev and the results discussed in the light of the theories of the stripping process.

Angular distribution measurements have been carried out on a number of proton groups from the bombardment with 8-Mev deuterons of targets of natural Mg and of Mg^{26}O and Mg^{28}O . Spins and parities have been assigned to various states of the product nuclei on the basis of the theory of the stripping process. These are given herewith, the excitation energy of each state in Mev being followed by the possible spin values and the parity in brackets: Mg^{25} : ground state $(\frac{5}{2}, \frac{3}{2}+)$, $0.582(\frac{1}{2}+)$, $0.976(\frac{5}{2}, \frac{3}{2}+)$, $1.957(\frac{5}{2}, \frac{3}{2}+)$, $3.405(\frac{1}{2}, \frac{1}{2}-)$. Mg^{26} : $1.825(3, 2+ \text{ and } 5, 4 \dots 0+)$, $2.972(3, 2+)$, $3.969(3, 2+)$, $4.353(3, 2+)$, $6.147(3, 2+)$. Mg^{27} : ground state $(\frac{1}{2}+)$, $0.887(\frac{5}{2}, \frac{3}{2}+)$, $3.50(\frac{1}{2}+)$. The following new energy levels have been observed: Mg^{25} : 4.62 ± 0.05 , 5.05 ± 0.08 , 5.49 ± 0.05 and 6.40 ± 0.05 Mev. Mg^{26} : 7.29 ± 0.06 and 8.28 ± 0.06 Mev. Mg^{27} : 3.50 ± 0.05 Mev. (auth)

2908

INELASTIC SCATTERING OF NEUTRONS BY Cd^{111} . A. E. Francis, J. J. G. McCue, and Clark Goodman. Phys. Rev. **89**, 1232-6 (1953) Mar. 15.

Neutrons with an energy spread of ± 40 kev bombarded a disk of natural Cd; among the products of bombardment was metastable Cd^{111m} produced by inelastic scattering. The yield of Cd^{111m} was measured from its threshold at 396 kev up to 1300 kev. Abrupt changes in the slope of the yield curve are interpreted as showing the onset of (n,n') excitation of higher levels. Such levels occur at 720 and 1150 kev. Below 720 kev, the Cd^{111m} was excited only by direct transition from the ground state. We have measured at 720 kev the cross section for this (n,n') event, which in-

volves known changes of energy, spin, and parity. The cross section is about 10 mb. 28 references. (auth)

2909

ABSORPTION OF ELECTRONS AND POSITRONS. L. Koester, H. Maier-Leibnitz, and K. Schmeiser. Z. angew. Physik 5, 9-11(1953) Jan. (In German)

Absorption measurements on positrons and electrons with the usual counter arrangements show that the absorption of positrons in Al is equal to, but in Cu and Au is significantly smaller than, the absorption of electrons of equal energy. The phenomenon is in agreement with a simple theory by which the effect of the different nuclear scattering of the positrons and electrons on the diffusion is predicted with the help of transport cross sections. (tr-auth)

2910

NEUTRON-PROTON SCATTERING USING ORGANIC CRYSTAL SCINTILLATION DETECTORS. M. E. Remley, W. K. Jentschke, and P. G. Kruger. Phys. Rev. 89, 1194-8 (1953) Mar. 15.

The angular distribution of protons recoiling from neutrons of 13.7 and 28.4 Mev has been investigated in the region of 0 to 90° in the c.m. system. Organic scintillation crystals of anthracene and stilbene were used at both sources and detectors of the recoil protons. The angular distribution observed at 13.7 Mev is consistent with spherically symmetric scattering, while the results at 28.4 Mev show an anisotropy with a favoring of scattering of the neutrons in the backward direction. 16 references. (auth)

2911

STUDY OF ELASTIC PION-HYDROGEN SCATTERING IN PHOTOGRAPHIC EMULSIONS. Gerson Goldhaber. Phys. Rev. 89, 1187-9(1953) Mar. 15.

Pion-H elastic scattering events were observed in photographic emulsions exposed to the 75 ± 5 Mev negative and positive pion beams of the Nevis synchrocyclotron. The methods of identification, based on the energy-momentum conservation in the interaction, are described. The cross section measured for the elastic scattering of negative and positive pions from H at 75 ± 5 Mev are ~ 3 and 41 ± 15 mb, respectively. (auth)

2912

APPLICATIONS OF VARIATIONAL PRINCIPLES TO SCATTERING PROBLEMS. Saul Altshuler. Phys. Rev. 89, 1278-83(1953) Mar. 15.

The Schwinger variational principle is reduced to a convenient form by using trial solutions of the form $\sum_i q_i u_i(x)$. The reliability of the formalism for polynomial trial solutions is studied for several fields, and wherever possible comparisons are made with phase shifts determined from other variational principles. The forward-scattering amplitude is determined variationally for scattering in the static field of the H atom, and it is demonstrated that the undisturbed wave as trial solution provides more accurate results for all incident energies than second Born approximation. The improved variational estimate of the total cross section for this field approaches that of Born at the higher energies. (auth)

2913

AN EXPERIMENTAL INVESTIGATION OF THE NUCLEON CASCADE IN WATER. C. B. A. McCusker, H. Messel, D. D. Millar, and N. A. Porter. Phys. Rev. 89, 1172-7(1953) Mar. 15.

The nucleon cascade in water produced by primaries of energy greater than 20×10^6 ev has been examined using an array of G-M counters and a 31-channel hodoscope. Over 15,000 showers have been studied. Transition curves for various primary energies, barometric coefficients for

various multiplicities and at different depths, rms lateral spreads, and intensities at different depths are given. The experimental results are compared with the theory of the nucleon cascade developed by Messel and his co-workers. In particular, the variation of lateral spread with depth substantiates their conclusion that the differential cross section for nucleon-nucleon collision at high energies has a very peaked form in the forward direction. 12 references. (auth)

2914

MEAN EXCITATION POTENTIALS. Donald C. Sachs and J. Reginald Richardson. Phys. Rev. 89, 1163-4(1953) March 15.

Previous experimental results of the present authors on the energy loss of 18-Mev protons in Al are corrected to give a value for the mean excitation potential $I = 168$ ev. It is pointed out that recent work on the range-energy relation for protons in Al may indicate a variation of I with proton energy which is considerably larger than that to be attributed to the nonparticipation of the K electrons. (auth)

2915

ON THE ENERGY LOST BY A RELATIVISTIC IONIZING PARTICLE IN A MATERIAL MEDIUM AND ON THE CERENKOV RADIATION. P. Budini. Nuovo cimento (9) 10, 236-59(1953) Mar. 1. (In English)

The problem of the energy lost by a relativistic ionizing particle in a polarizable material medium is studied by considering separately the energy dissipated in proximity to the track of the ionizing particle and that emitted at a larger distance as radiation (Cherenkov radiation). A general formula is stated which allows the calculation of the energy locally dissipated (valid for impact parameters larger than atomic dimensions) whatever may be the mechanism of the dissipation process. It is found that in the separation of the energy loss into energy absorbed in the excitation of the atoms of the medium and energy dispersed as Cherenkov radiation, an essential role is played by the ratio of the breadth of the spectroscopic lines to the density of the medium. In the case of emulsions in particular, it is possible to explain the rapid increase beyond the minimum experimentally observed. A formula allowing the calculation of the intensity and the spectral distribution of the Cherenkov radiation also is given. It is pointed out that in particular there should exist some relation between the broadness of the spectroscopic lines and the structure of the Cherenkov bands suitable for experimental verification. In the case of solids, only the natural width of the lines required by the uncertainty principle should prevent the emission of part of the Cherenkov bands in the x-ray region. This theory leads to the expectation that in the case of dense media a simultaneous increase of ionization and Cherenkov radiation ought to be observed in favorable conditions. (auth)

2916

APPLICATION OF THE MULTIPLE SCATTERING THEORY TO CLOUD-CHAMBER MEASUREMENTS. II. M. Annis, H. S. Bridge, and S. Olbert. Phys. Rev. 89, 1216-27(1953) Mar. 15.

The theory of multiple coulomb scattering discussed in Part I (NSA 6-5496) has been applied to some specific problems in the analysis of data obtained with a multiplate cloud chamber. In particular, the problem of estimating the momentum (or, more exactly, the quantity $\Pi = pc\beta$) for a single particle is discussed, and a procedure for determining mass using scattering and residual range is given for the case of a group of particles homogenous in mass. In the case of an inhomogeneous group of particles, it is shown that the distribution function for values of the mean square angle of scattering in n plates can sometimes be used as a basis

of separation into nearly homogeneous mass groups. In addition the distribution of the mean square angles provides an estimate of the error in Π or in the value of the mass. These methods are illustrated by a determination of the masses of the proton and meson using a mixture of these particles observed in a multiplate cloud chamber. In the theory developed in Part I it was assumed that the probability for single coulomb scattering goes abruptly to zero for angles greater than $\varphi_0 = \varphi_m a/r_n$, where φ_m is the screening angle as given by Molière, a is the Thomas-Fermi atomic radius, and r_n is the nuclear radius. As a result of this assumption the mean value of the scattering angles, for means of order two and higher, remains finite as contrasted with the result of Molière or Snyder and Scott where the mean square angle of scattering is infinite. Consequently either the mean of the absolute values of the scattering angles or the rms angle of scattering can be used in the above applications. Both cases are given. The above assumption as to the cut-off angle for single scattering affects the value of the rms angle of scattering only slightly; it is shown, however, that the behavior of the "tail" of the distribution function depends critically on the choice of φ_0 . Consequently, the value of Π or of the mass is not greatly dependent on the particular theory of multiple scattering used, but the probability of scattering through angles large compared with the rms angle is. The difficulty of identifying a nuclear scattering by this method is emphasized. (auth)

2917

GAMMA-RADIATION FROM INTERACTION OF 14-MEV NEUTRONS WITH IRON. V. E. Scherrer, R. Theus, and W. R. Faust. *Phys. Rev.* 89, 1268-70 (1953) Mar. 15.

Experiments have been performed to observe γ rays produced by the interaction of 14-Mev neutrons with Fe. Although the γ spectrum appears to be continuous below 3.0 Mev, there may be discrete γ rays at 3.3, 4.4, 5.8, 7.1, and 8.75 Mev. The total cross section for γ -ray production is 4.6 ± 0.5 b. (auth)

RADIATION EFFECTS

2918

Atomic Energy Research Establishment, Harwell, Berks (England)

THE INFLUENCE OF CROSSLINKING ON THE ELASTIC MODULUS OF POLYTHENE. A. Charlesby and N. H. Hancock. Dec. 3, 1952. 11p. (AERE-M/R-1060)

The effect on Young's modulus E is studied when polythene is crosslinked by pile irradiation. Dynamic and static measurements of E are given at various temperatures and for varying degrees of crosslinking. At room temperature E decreases at first with increasing crosslinking, resulting in a more flexible polymer. With further crosslinking, E increases rapidly as a glass-like amorphous structure is produced. With increasing temperature, E decreases up to a temperature of $\sim 115^\circ\text{C}$ when all crystallinity disappears. Beyond this point, E increases with T , approximately obeying the relationship $E = n\rho R_g T/M_c$ where ρ is the density, R_g the gas constant, T the absolute temperature, and M_c is the average molecular weight between crosslinks. The value of n obtained experimentally is approximately 2. For highly irradiated material, with about one crosslink per 2.5 carbon atoms, this formula no longer applies. The application of this formula to partly crystalline material is discussed. (auth)

2919

Sarah Mellon Scaife Radiation Lab., Univ. of Pittsburgh RADIATION DAMAGE STUDY; REPORT NO. 1 [FOR] APRIL AND MAY 1952. 17p. (NP-4443; Report No. 1)

The primary purposes of the Radiation Damage Project

are: to irradiate samples of various compounds (i.e., rubber, O rings, oil, grease, refrigerants, etc.); to ascertain the effects of the radiation upon above compounds; and to recommend certain of these compounds which would best serve a given purpose under irradiation. The secondary purpose of the project is to, by some method, determine the dosage (in roentgens) delivered to the sample. (auth)

2920

EFFECT OF X-RAY IRRADIATION ON THE SELF-DIFFUSION COEFFICIENT OF Na IN NaCl. Dillon Mapother. *Phys. Rev.* 89, 1231 (1953) Mar. 15.

The self-diffusion coefficient of the Na ion in NaCl is decreased if the crystal is exposed to x rays during the diffusion process. This effect was observed at temperatures under 550°C and was not observed at higher temperatures. (auth)

RADIOACTIVITY

2921

Kansas State Coll.

HIGH ENERGY GAMMA RADIATIONS OF TUNGSTEN. C. M. Fowler, H. W. Kruse, and G. P. Mellor. [1952]. 3p. (AECU-2452)

Gamma radiations from W^{182} were studied for the energy region above 500 kev. By employing β spectrometers with fields up to 550 gauss a number of conversion groups were observed. The group energies and their assignments to γ rays are listed. (L.M.T.)

2922

Yale Univ.

INNER BREMSSTRAHLUNG ASSOCIATED WITH K-CAPTURE IN A^{37} . Carl E. Anderson, George W. Wheeler, and W. W. Watson. [1952] 12p. (NYO-3024)

An investigation has been made of the inner bremsstrahlung, accompanying K capture in A^{37} . The inner-bremsstrahlung energy distribution was examined by absorption and scintillation-spectrometer techniques and found to agree with that predicted by theory. A Kurie-type plot showed the maximum energy of the γ radiation to be 815 ± 15 kev. (auth)

2923

STUDY OF THE RADIATIONS EMITTED BY I^{126} . Nadine Marty, Hélène Langevin, and Pierre Hubert. *Compt. rend.* 236, 1153-5 (1953) Mar. 16. (In French)

The β^+ , β^- , and γ radiations of I^{126} have been studied in detail with a magnetic-lens spectrometer and scintillation counters. A complete decay scheme is shown. (G.Y.)

2924

PSEUDOSCALAR MATRIX ELEMENT IN BETA-DECAY.

M. Ruderman. *Phys. Rev.* 89, 1227-30 (1953) Mar. 15.

The interpretation of the β spectrum of RaE (Bi^{10}) seems to need a mixture of pseudoscalar and tensor interactions. Estimates of the necessary G_p give $G_p \gg G_T$ to compensate for the small pseudoscalar matrix element. This matrix element is greatly increased if the nucleon is in a potential which strongly mixes free-particle states of positive and negative energies even though the diagonal terms are not large. Such an interaction arises from pseudoscalar meson theory. The pseudoscalar matrix element is calculated for the RaE decay assuming that the nucleons interact through pseudoscalar-coupled pseudoscalar mesons. Exchange transitions, in which two nucleons exchange the charge and spin given to the electron and neutrino, predominate. The RaE spectrum can be fitted with $G_p \sim -G_T$. Exchange terms alter other momentum-type matrix elements appreciably. Such effects are unimportant for gradient-coupled pseudoscalar mesons. 18 references. (auth)

2925

GAMMA RADIATION OF 18-MIN Br^{30} . Jeanne Laberrigue-Frolow, René Bernas, and Hélène Langevin. *Compt. rend.*

236, 1246-8(1953) Mar. 23. (In French)

In order to avoid interference by the Br^{82} present in a previous study of the Br^{80} radiations (NSA 6-5519), a Br sample isotopically enriched to 96% Br^{80} was used for preparation of 18-min Br^{80} by pile irradiation. The ratio of high-energy γ rays to electrons was ≈ 0.035 , a ratio too low to agree with the Fermi-analysis prediction that 15% of the β^- decays go to a 1-Mev energy level of Kr^{80} . (G.Y.)

2926

EVIDENCE FOR THE NATURAL RADIOACTIVITY OF RHENIUM BY THE NUCLEAR EMULSION METHOD.

Bernard Gauthé and Jacques M. Blum. *Compt. rend.* 236, 1255-6(1953) Mar. 23. (In French)

Ilford G5 emulsion was used in two different ways to study the β radiation of Re^{187} . In the first method, a drop of acetone solution of the perrhenate of methylene blue was placed on the surface of the emulsion immediately after the latter was poured. A histogram of 500 tracks obtained in the impregnated zone shows a maximum at a range corresponding to 11 kev. The resolution is too poor to decide whether this represents a maximum of a continuous spectrum or an intense conversion or Auger line. In the second method, study of the histogram of 300 tracks from a Na perrhenate-filled capillary tube buried in the emulsion permitted extrapolation to a lower limit for the maximum β energy of 34 kev. (G.Y.)

2927

INVESTIGATION OF THE Zn^{65} RADIATIONS. Mitsuo Sakai and Pierre Hubert. *Compt. rend.* 236, 1249-51(1953) Mar. 23. (In French)

Study of Zn^{65} with a magnetic-lens spectrometer led to information on the γ radiation and its conversion coefficient ($\alpha_{\text{total}} = 1.8 \pm 0.2 \times 10^{-4}$), on the β^+ spectrum (shape and energy; $E_{\text{max}} = 327 \pm 3$ kev), and on the $N_\gamma N_{\beta^+}$ ratio ($29 \pm 5, 24 \pm 4$, or 26, depending on the method used). (G.Y.)

2928

Re^{188m} , A NEW NUCLEAR ISOMER OF $T = 18.7$ Min HALF LIFE. A. Flammersfeld. *Z. Naturforsch.* a8, 217-18(1953) Feb.-Mar. (In German)

Irradiation of Re metal with either thermal or fast (Be-D) neutrons produced a new isomer, Re^{188m} , of 18.7 ± 0.3 min half life. For the natural Re isotopic mixture, the cross section for Re^{188m} production is $1.0 \times 10^{-24} \text{ cm}^2$ for thermal neutrons. The weak γ radiation ($E_\gamma = 0.060$ Mev) is probably the result of an E3 or M3 transition. (G.Y.)

2929

THE RADIOACTIVE DECAY OF TUNGSTEN 187. J. M. Cork, M. K. Brice, W. H. Nester, J. M. LeBlanc, and D. W. Martin. *Phys. Rev.* 89, 1291-2(1953) Mar. 15.

Using sources derived from neutron capture in enriched (97.5%) W^{186} , about 40 internally converted electron lines are recorded in photographic magnetic spectrometers. Their interpretation leads to the evaluation of 14 γ -rays in Re^{187} , seven of which had not been previously observed. It is possible to arrange these transitions in a consistent level scheme for the Re^{187} nucleus. The K/L ratios are determined for five of the γ rays and the multipolarity and nature of the transitions proposed. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

2930

Ames Lab.

ABSORPTION SPECTRUM OF THULIUM SULPHATE OCTAHYDRATE. Arthur Paskin and J. M. Keller. Mar. 1953. 139p. (ISC-310)

The term splitting of the absorption spectrum of thulium sulphate octahydrate due to crystal field effects was calculated according to first-order perturbation theory. Departures from Russell-Saunders coupling were taken into account.

The various transition mechanisms were examined with and without crystal coupling. It was found that crystal-coupling effects are important in destroying J and parity selection rules. Transitions induced by these effects are often more important than transitions calculated neglecting crystal coupling. Zeeman patterns were also studied for the several interesting directions of propagation and polarization of the light relative to the magnetic-field direction. Susceptibility calculations made for Tm, Pr, and Nd sulfate octahydrate indicate field calculations cannot always be made neglecting all but nearest neighbor contributions. (auth)

2931

INTERATOMIC ELECTRIC QUADRUPOLE-QUADRUPOLE COUPLING IN SALTS OF CERIUM. R. Finkelstein and A. Mencher. *J. Chem. Phys.* 21, 472-9(1953) Mar.

The magnetic properties of a Ce salt in terms of the one-atom (crystalline field) model at temperatures greater than 1°K are calculated. Because the Ce ion is not in an S state, its electronic charge distribution has a quadrupole moment. The influence of interatomic electric quadrupole-quadrupole interactions on the magnetic moment and optical rotation at very low temperatures is determined. In Ce ethylsulfate this coupling is antiferromagnetic with a characteristic temperature of $\tau = 0.01(r^2)^4$ degrees, where $(r^2)^{1/2}$ is the rms radius of the 4f orbit in Å. This interaction may be at least partly responsible for a low temperature anomaly found by Becquerel, de Haas, and van den Handel, as well as for the sharp increase in specific heat noticed during adiabatic demagnetization. In other salts τ may be of opposite sign (ferromagnetic case) and possibly much larger ($\sim 1^\circ\text{K}$). (auth)

SPECTROSCOPY

2932

Kansas State Coll.

BETA-RAY SPECTROMETER LINE SHAPES WITH TILTED SOURCES. H. W. Kruse, G. P. Mellor, and C. M. Fowler. [nd] 6p. (AECU-2453)

Experimental line shapes arising from tilted β -spectrometer sources are compared with analytically derived line shapes. Although the increased scattering in the source at higher tilting angles considerably alters the experimental line shape, the sharp leading edges predicted for the larger angles are largely retained. This is true for electron energies at least as low as 400 kev, even for quite dense sources (5 mg/cm^2). An application of the increased resolution resulting from this feature is given. (auth)

2933

Applied Research Labs., Glendale, Calif.

RESEARCH INVESTIGATIONS DIRECTED TOWARD ESTABLISHMENT OF METHODS FOR QUANTITATIVE SPECTROGRAPHIC ANALYSES OF RAW AND PROCESSED MATERIALS: SECOND QUARTERLY REPORT [FOR] JANUARY 18, 1952 TO APRIL 15, 1952. M. F. Hasler and J. W. Kemp. 17p. (NP-4460; U-22481; Progress Report No. 2)

Progress is reported on the development of the Be-Cu multiplier and the soft x-ray tube. The results of studies of the analysis of several titanates and of Al alloys by a nondispersive x-ray analyzer are reported. The method appears to offer a possible solution to a number of analytical problems. An instrument is described that has been designed to test the excellence of various crystals for the diffraction of fluorescent x rays. (For previous period see NP-4343.) (auth)

2934

EMISSION AND ABSORPTION L SPECTRA OF GADOLINIUM AND THULIUM. Paul Sakellaridis. *Compt. rend.* 236,

1244-6(1953) Mar. 23. (In French)

Experimentally determined L x-ray emission and absorption spectra of Gd and Tm are tabulated. (G.Y.)

2935

EMISSION AND ABSORPTION L SPECTRA OF HOLMIUM.

Paul Sakellaridis. Compt. rend. 236, 1014-16(1953) Mar.

9. (In French)

Experimentally determined L lines of the x-ray emission and absorption spectra of Ho are tabulated. (G.Y.)

THEORETICAL PHYSICS

2936

SELECTION RULES IMPOSED BY CHARGE CONJUGATION.

L. Michel. Nuovo cimento (9) 10, 319-39(1953) Mar. 1.

(In English)

A systematic study is made of the invariance of field theories under charge conjugation in order to indicate all possible selection rules due to charge conjugation alone or combined with charge symmetry or charge independence. It is shown that when isotopic spin formalism is used, invariance under charge conjugation corresponds to conservation of isotopic parity. (auth)

2937

CONSERVATION OF QUANTA FOR NONLOCAL FIELDS.

Christopher Gregory. Phys. Rev. 89, 1199(1953) Mar. 15.

A definition of spatio and/or temporal integration of non-local expressions is set forth. The latter is applied to the computation of the momentum-energy vector and an invariant from nonlocal expressions corresponding to the stress-energy momentum tensor and a four-vector. The latter four-vector is interpreted to be the quantum current density, and the invariant surface integral of this four-vector over a space-like surface is associated with the operator for the number of quanta. Application to a massless boson field leads to the conclusion that only the energy is positive definite, while the operator for the number of quanta is not, even though the boson field is real (Hermitian). In the usual quantum theory of fields a four-vector current exists only for complex fields. (auth)

TRACER APPLICATIONS

2938

STUDIES OF THIN ADSORBED STRATA BY MEANS OF RADIOACTIVE TRACER ELEMENTS; PHYSICAL

CHEMISTRY. Rene Bernard, Francois Davoine, and Jean Hirtz. Translated from Compt. rend. 232, 1826-8 (1951)

4p. (AEC-TR-582; AERE-Trans. 11/3/5/158)

URANIUM AND URANIUM COMPOUNDS

2939

FISSION NEUTRON SPECTRUM OF U²³⁵. David B.

Nicodemus and Hans H. Staub. Phys. Rev. 89, 1288-90

(1953) Mar. 15.

A high-pressure ionization chamber has been used to measure the energy distribution of proton recoils from the neutrons which are emitted during the thermal-neutron fission of U²³⁵. The energy spectrum of the fission neutrons is obtained by applying suitable wall corrections and by using 2.5-Mev D-D neutrons for an energy calibration. Measurements were made in the range from 1 to 4 Mev, and within the experimental errors, the resulting fission spectrum follows Watt's (Phys. Rev. 87, 1037(1952)) semi-empirical relation, $N(E) = e^{-E} \sinh \sqrt{2E}$. (auth)